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THE

U. S. NAVAL ASTRONOMICAL EXPEDITION

TO

THE SOUTHERN HEMISPHERE,

DURING

THE YEARS 1849–'50–'51–'52.

SUPPLEMENTARY PAPERS.

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THE ANDES AND PAMPAS (Parts I and II)	By Lieut. Archibald MacRae.
MINERALS	J. Lawrence Smith.
INDIAN REMAINS	Thomas Ewbank.
MAMMALS	Spencer F. Baird.
BIRDS	John Cassin.
REPTILES, FISHES, AND CRUSTACEA	Charles Girard.
SHELLS	A. A. Gould.
DRIED PLANTS	Asa Gray.
LIVING PLANTS AND SEEDS	William D. Brackenridge.
FOSSIL MAMMALS	Jeffries Wyman.
FOSSIL SHELLS	T. A. Conrad.

INTRODUCTORY.

The magnetical observations proposed in the programme for the Expedition submitted to the American Philosophical Society and Academy of Arts and Sciences, and which was adopted by the honorable Secretary of the Navy, contemplated only a determination of the three elements on the *term-day* of each month, with occasional observations on the same days for horary changes of the declination. After the instruments arrived, it was found that we might multiply the number of absolute determinations without adding excessively to our labors; and, consequently, the experiments were made on the 1st and 11th days of each month also. The three years' results carefully compared would afford interesting data for secular changes; but there was yet another question which the Andes might enable us to elucidate satisfactorily—viz: the variation of the elements, and more particularly of the total force with distance from the centre of the earth. This determined me to place the instruments in charge of Lieut. MacRae, as soon as our use of them in Chile terminated, and instruct him to return home via the Cumbre and Uspallata passes and Buenos Ayres. The observations indicated to him were for elevation, latitude, longitude, declination, inclination, and horizontal force of the magnet and meteorological data, for each three thousand feet elevation ascending the western and descending the eastern slopes of the Andes, and for each hundred miles of longitude between the cities of Mendoza and Buenos Ayres. Other information of a geographical and statistical character was specified as greatly interesting to numerous classes of our countrymen.

We left Chile on the 1st of October, but the snow had not sufficiently melted on the pass to warrant the departure of Lieut. MacRae from Santiago before the 8th of November. The entire journey to Buenos Ayres occupied him about sixty days, twelve of which were employed in observations within the Andes. Accidents on two occasions having caused the breakage of his mountain barometer, and such injuries to his chronometers as might place the longitudes of his stations in doubt, on arriving in the United States, he, with the most laudable zeal, volunteered to retrace the route at his own cost if a new set of instruments could be supplied. This, as well as the charges for their transportation, was promptly authorized by the honorable Secretary of the Navy; and Lieut. MacRae re-embarked for South America in August, 1853. He finally returned in the following March, and shortly afterwards submitted the following report of his two expeditions.

After enumerating the various observations legitimately comprised within the purposes for which the Expedition was solicited of Congress, the programme above referred to goes on to say: "These nine classes or series of observations embrace as great an amount of labor as it will be prudent for two observers to undertake, and even its accomplishment must, of necessity, leave all reductions until after the return of the Expedition to the United States; but, (whilst I disclaim knowledge of almost every branch of natural history,) as so little has been learned of the immediate country we shall probably select, if the collection of specimens at leisure hours, remarks concerning the flowering of plants, the migrations of birds, or other designated phenomena, would be of interest from one so unskilled, the enterprise is embarked upon with full determination to gather every scientific fruit that may offer."

Immediately after arrival in Chile, it was ascertained that, under the liberal patronage of its government, no one field of its natural history had been uncultivated, and those who would

follow the comprehensive harvests reaped by M. Claude Gay could be, at best, but gleaners. The specimens collected by him during several years of assiduous labor had been sent to Paris for description and illustration; and already several octavo volumes of letter-press, with many superbly colored folio plates, had reached Santiago. Subsequently, the zoology and botany, comprising 16 volumes of text and 224 plates, have been completed. Nevertheless, elaborate as his work promised to be, and small as was the probability that we should be able to add any mites to the stock of knowledge contributed by him, in the expectation that they would prove of interest to the students who seek the National Cabinet at Washington, I lost no occasion to collect specimens from every available quarter. In this, more than one friend, foreign as well as native, aided me; some contributing antiquities, and others rare ores, neither of which are certainly attainable except through such influence. To these generous friends, therefore, we are under obligation for the especially rare objects described both in the mineralogical and ethnological reports. Nor did their considerate and kind liberality end with my residence in Chile; for more than a year after arriving at home, there reached me a fine specimen of that very rare mammal—the *Chlamyphorus truncatus*—a fossil mastodon tooth, many birds of particular interest, and several hundred minerals.

Moreover, whenever opportunity offered during our three years' residence abroad, seeds and bulbs, or thriving specimens of valuable or curious plants, were forwarded to the conservatory at Washington; and from there large numbers of useful varieties have already been distributed. By authority from the honorable Secretary of the Navy, all the other portions of the collection were placed in charge of the Smithsonian Institution, with a request to distribute them among naturalists for proper description, and drawings of every object not previously figured. Ample funds were placed subject to the control of the Smithsonian Institution, and it alone is responsible for the manner in which the work has been accomplished. The enviable reputations of the gentlemen selected, is ample guaranty for the fidelity and ability with which their several tasks were executed; and it is hoped that the collection brought home by the Astronomical Expedition will not be without value to the naturalists of the United States.

The "Anales de la Universidad de Chile," for June, 1854, reached me after the report on minerals had been printed. It contains the first authentic account of the locality where the great Atacama meteor exploded, with interesting details, which merit translation and publication here for the benefit of mineralogists who may never receive the "Anales." The recognised ability of the author—Dr. R. A. Philippi—is a sufficient guaranty for the accuracy with which he will make known every incident of his journey to that inhospitable region.

J. M. G.

U. S. N. Astronomical Expedition,
Washington, August, 1855.

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BY LIEUTENANT ARCHIBALD MACRAE.

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MAP

of the

USPULLATA & PORTILLO PASSES

across the

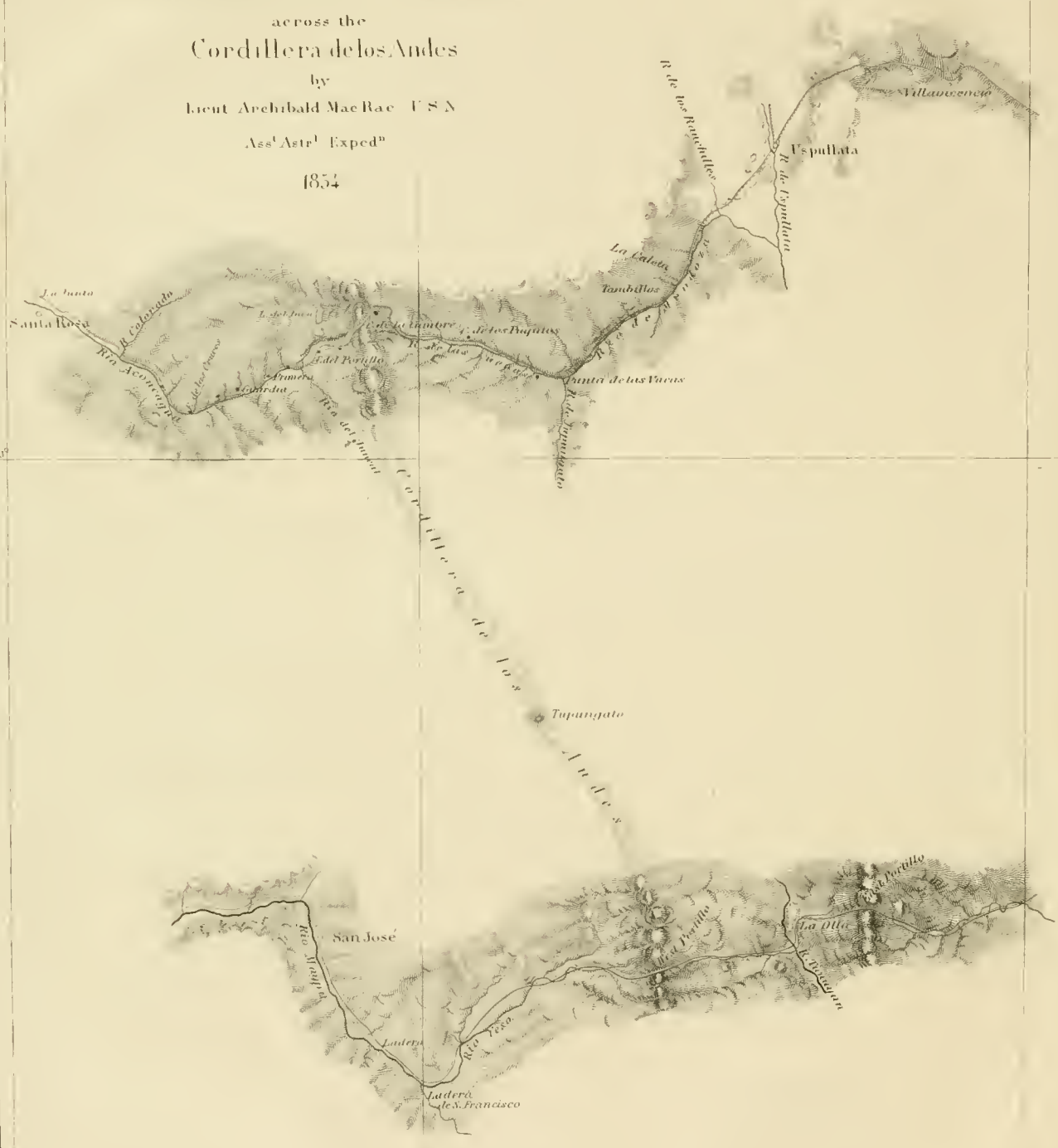
Cordillera de los Andes

by

Lieut Archibald Mac Rae U S N

Ass.t Astr.l Exped.n

1854



Drawn by Fr.s Herbst C. E.

THE ANDES AND PAMPAS.

CHAPTER I.

FROM SANTIAGO TO MENDOZA BY THE USPALLATA PASS.

OCCUPATION PENDING MY DEPARTURE.—DIFFICULTY IN MAKING ARRANGEMENTS FOR ANIMALS.—DEPARTURE.—SANTA ROSA.—CHACRA DE MONTUMAS.—PREPARATION OF FOOD FOR THE MOUNTAINS.—SANTA ROSA.—ESTERO DE LAS CRUCES.—LADERAS.—CASUCHAS.—GLACIER.—OJOS DE AGUA.—ALTO DE LA LAGUNA.—MOUNTAIN LAKE.—CUMBRE.—PUNA.—CONTRABANDISTAS.—CONTRAST BETWEEN THE TWO SIDES OF THE MOUNTAIN.—CASUCHA DE LOS PUQUIOS.—DIFFERENCE BETWEEN THE STREAMS ON THE TWO SIDES OF THE PASS.—FATE OF THE CONTRABANDISTAS.—HOSPITALITY OF THE ARRIEROS.—INCA'S BRIDGE.—CERRO DE LOS PENITENTES.—TUPUNGATO.—LADERA DE LOS POLVADERAS.—LADERA DE LOS CORTADERAS.—FALSE SUNSET.—USPALLATA.—INSTANCE OF THE VALUE OF MADRINAS.—VILLAVICENSIO.—THE PLAIN.—MOCKING BIRDS.—ARRIVE AT MENDOZA.—STREAMS PASSED IN THE MOUNTAINS.—ANIMALS AND BIRDS.

A part of your instructions, directing me to inform myself about the course and ultimate termination of certain rivers; their capabilities for navigation, &c.; of the moral and social condition of the people; the prevailing diseases, virtues, and vices of the different communities through which I might pass; their mineral and agricultural resources, &c., &c., are too wide in their extent for me to furnish, from personal experience during two hasty trips, made with very limited means, and more limited knowledge of natural science, any other than a shadow of the information desired; and this, meagre as it is, is not of sufficient importance to be put in a separate or tabular report.

In European or North American cities and provinces, registers are kept, containing full information on all these points, and there is no difficulty in obtaining it; but in the thinly settled provinces of that part of South America through which my road lay, no such records are to be had.

Therefore, after due consideration of these facts, I have concluded that the best I can do will be to give my limited information as it was received, in connection with a narrative of my journeys.

The time intervening between the departure of the other members of the expedition and the opening of the mountain pass over which I was directed to go, was spent in the enjoyment of the posthumous reputation of the party, which, I am sorry to say, was not very agreeable.

Our existence had ceased so recently, that people were not yet prepared to occupy themselves with more than our faults; and as I was, so to speak, the tombstone on which they read our supposed virtues and merits, I had at times to learn that our reputation was not in every respect

equal to what we had expected. Whether the fault was with the "tombstone," or with the departed party, I am unable to say.

Except the advent of a dead bishop—visiting whom gave me constant occupation and pleasure, till the odor of his sanctity became too great—and an occasional religious procession, nothing occurred to relieve the tedium of waiting.

These processions differ from each other only in the number of saints, sinners, and candles used on the occasion, and therefore it is unnecessary to enter into a history of them; a few days before my departure, however, I learned of a feature in some of them entirely new to me, which may be worth relating.

On the day preceding that of San Francisco, I met a procession in the street going towards the church of that name, having under convoy the most superbly dressed image of a saint that I had ever seen. Except for his shaven crown he might have passed for one of the magnificent monarchs of the magnificent age of France, but turned out to be San Francisco himself, on his way to church to preside over the fiesta of next day. Doña Francisca de Fulano de Tal had, at her own expense, extracted him from his altar in the church and dressed him in this splendid manner for the occasion.

Fully impressed, from this circumstance, with the importance of his character, I did not fail to attend mass the next day, and found that I was not the only person attracted by the finery of his dress. Old women and young women, priests and priestlings, were enthusiastic in their devotions; and even San Antonio himself, who is the patron saint of marriages, lovers, and sailors, was almost entirely neglected.

On the following day, as I was going up a retired by-street, I met four peons trotting hastily along with an exceedingly dilapidated looking saint on a litter, whom, upon examination, I found to be no other than my quondam acquaintance San Francisco; but so ragged and dirty in his appearance that he was evidently ashamed of himself, and did not wish to be recognised.

On inquiry I learned that his rich robes had been taken off in order to preserve them for the next annual fiesta; Doña Francisca de Fulano de Tal having no idea of allowing him to luxuriate in fine clothes except on that day, when he was particularly her patron.

The only real occupation I had, pending my departure, was to get a travelling rate for the pocket chronometers, and make arrangements for mules to take me to Mendoza. The first I endeavored to accomplish by wearing the three chronometers on my person in the same position I proposed to carry them in travelling, and making it a point to ride and walk about a good deal every day. I soon found, however, that two of them performed so irregularly as to be nearly useless for the determination of longitudes.

To obtain mules at anything like a reasonable rate was much more difficult, particularly as I had to stipulate that we should stop when and where I pleased; and my difficulties were increased by the manœuvres of a noted birlochero named Ascencio Palma, certainly the keenest knave in a bargain about horses or gigs I ever saw. His most common trick, when any one wished to hire a birlocho (gig) for Valparaiso or elsewhere, was to come himself, make an offer at a very high figure, and if he failed in making a contract, retire, advising the applicant to give up all idea of the trip, as he certainly would not find any cheaper mode of conveyance. Half an hour afterwards some other fellow would make his appearance, and propose to carry the voyager for a little less; until, finally, some one would make a really fair offer to those who had the patience to wait; and then after the contract was completed, in would walk master Ascencio, or "Chencho" as he is called, and the fact would be learned for the first time that every one who had offered was his agent.

Something of this kind was attempted with me. His first proposal, made in person, was to take me to Mendoza for $138; but, by the advice of those acquainted with the subject, I declined it, and cast about for better terms. In the mean time, a foreign merchant, with whom I had long been acquainted, wrote to a friend in Santa Rosa—the headquarters of muleteers—and requested him to send down one who would take me over at a reasonable rate. At the end of

a week he received an answer stating that there had been but one offer, which was to take me on the stipulated conditions for $155—the writer going into a long statement to prove that the offer was very liberal; adducing to this effect items unheard of in the ordinary rules of transportation across the mountains, reminding me forcibly of the story of an old whaler, Christopher Dolphin by name, who said that when fitting out for his first voyage to sea, the slop-shop man, after imposing on him everything of possible utility, recollected that it would be necessary for him to have a left-handed palm with which to thrust the sail-needle back after he had shoved it through with the right. I of course rejected this offer, and afterwards learned that as soon as Palma heard of the letter, he had sent his son to Santa Rosa, who had frightened off all competitors by stories about the length of time I intended to stop in the mountains, and had himself been the bidder.

I finally made an arrangement for $86 with an honest fellow, who would have taken me at a more reasonable rate if I had not been obliged to stipulate about stopping at several points on the road. My contract was, to be furnished one saddle-mule and two others for the baggage, and be accompanied by the arriero himself and a peon. These were to saddle and unsaddle for me, and have all the care of the mules; in addition to which, they were to furnish me with the same food they themselves had.

At length, on or about the 8th of November, the first courier arrived at Santiago reporting the cordillera open, and on the 10th my arriero came in with his mules; but the state of my health did not permit me to start till the 15th of the same month, when, after taking leave of all my kind friends, I set out in company with Colonel Peyton, the American minister to the Chilean government, who did me the honor to accompany me a few leagues on the road. We parted about eight miles out, and when fairly alone, with nothing to think of but myself, I began to be aware that I had undertaken no easy task. I had slung across my shoulders a mercurial barometer, an aneroid and a pocket compass, and around my waist three pocket chronometers and the little money I possessed; and by the time the sun had reached the meridian, these weighed quite enough to make them burdensome. The day was warm and the road dusty; and notwithstanding the latter led between finely cultivated fields, with occasional country seats in excellent order, long before our arrival at our first stopping place I was essentially used up, and incapable of enjoying either cultivation or scenery.

At nightfall we arrived at the Posada (inn) of Chacabuco, where we remained till morning. Before arriving, however, I was relieved of part of my load. On mounting at the hill of Colina, the aneroid barometer caught in the holsters, broke its sling, and in the fall its chain parted, so that, as it was no longer of use, I stored it away with the baggage.

On the morning of the 16th set out again, and very shortly reached the wide range of hills called Cuesta de Chacabuco. Passing this, we entered the rich and picturesque valley of San Felipe, and a few miles more brought us to a lane called the Calle-larga, or long street, of Santa Rosa. Certainly, to the weary traveller no street ever deserved that name more: at first there are no houses—only walks enclosing fields and orchards; but at a short distance, houses are not unfrequent, and become more numerous up towards a focus, where the presence of a dry-goods store, and two or three grog-shops, leads one to suppose that he has finally arrived at Santa Rosa. A few squares farther on, however, and the voyager is in the country again. I do not know how many of these little eruptions of houses there are, but recollect that after repeated disappointments, I began to think the arriero was misleading me, or that no such place as Santa Rosa existed. Nevertheless, we did eventually arrive at a town fairly brought to a stand near the bank of the river Aconcagua; and I could not help thinking it very fortunate that nature had placed this barrier there, as it is impossible to say where the town would have got to, but for that stream.

My arriero lived about three miles beyond, and as all his preparations were to be made there, I determined to stop at his farm instead of in the town; so we pushed on, crossing the river at a part where stony islands divided it into three streams. This was my first experience in

crossing a rapid mountain stream; and as the Aconcagua in the early part of the spring, when the snows begin to melt, is very formidable, it was nearly my worst. At first I looked at the river and the mules ahead; but the rapidity of the one, and the slow progress of the others over the rounded stones, made me giddy. I could not get rid of the idea that we were all being washed down the stream; and if I had not ceased gazing at the rushing water, and looked at the sky only, as is common with persons ascending giddy heights, I should have fallen off the mule. This is, I believe, the experience of all new hands.

Each of the streams at the ford was about twenty-five yards wide, two feet deep, and very rapid.

On our arrival at the farm of the arriero, we gave ourselves up to rest for the remainder of that day.

Passed the 17th in making a set of observations—the arriero and his family being occupied meanwhile with the necessary preparations for the voyage, which consisted in shoeing the mules and getting ready our provisions. The food usual and most adapted to the mountains is charqui or dried beef, which instead of being made in junks, like that we are accustomed to see, is dried in thin sheets. For use it is either roasted in its ordinary state, or, what is most common in the cordillera, baked and afterwards pounded till it is reduced to powder; and when so prepared, nothing more is necessary to make a savory mess of it than to put five or six tablespoonfuls in a tin pot, break up with it some crackers or bread, and throw in a few slices of onion; then fill the pot with boiling water, and after allowing it to steep for fifteen minutes, you have as savory and nourishing a dish as can be prepared with the limited amount of cooking utensils of a traveller among the Andes. It is probably the food best adapted to the thin air of the mountains; and as its bulk is very small, it deserves precedence over all other.

On the 18th, as we were not quite ready, I rode back to Santa Rosa, and made a set of observations for latitude and longitude. As I did not consider my work to commence until we entered the mountains, I took no pains to inform myself as to the population of the place, &c. Nor did it appear to be a very easy matter, for the town extends over so much ground that it is difficult to say where its limits end and the country begins. It has a public plaza, two alamedas—shaded, as usual, by Lombardy poplars—at least one church, one school-house, one inn, and two or three apothecary-shops. The best idea I could form of the condition of the arts and sciences was derived from the fact that there was no one capable of repairing the chain of the aneroid barometer. The only place in the town where anything of the kind could be done was at a silversmith's, where the principal occupation of the workmen was making ornaments for spur and bridle mountings. As for the inn, it was bad enough, and it cost us a good deal of trouble to find it. We asked for it under every possible name we could think of, and at length found one person sufficiently intelligent to divine that we meant the "billar," or billiard-room, as it is called, and there we accordingly repaired. The one billiard-table it contained was unique of its kind; it was about eight feet long and four broad, with pockets large enough for a ten-pin ball, and gutters had been worn from the middle of the table towards the pockets. At twelve and a half cents for a game of thirty, it appeared to be a profitable piece of furniture. As for the food, it is only necessary to say that in any house in Chile, however humble, the traveller can obtain a good cazuela—a kind of vegetable soup, peculiar to that country—and an epicure need not ask for anything better. The "billar" has rooms for lodgers; but as I did not try them, I can only say that they looked uncomfortable.

November 19, 1852.—Having made all preparations, we set out from the chacra de Montumas for the mountains, our party consisting of the arriero, his peon, and myself; and, until we were clear of the settlements, there was a boy to lead the madrina (god-mother) or bell-mare. Of animals we had three saddle-mules, two burden-mules, a spare one for a change in case of necessity, and the madrina.

Two miles to the southward, on the road to Santa Rosa, brought us to a little settlement called La Junta, where we turned off to the eastward, near the north bank of the Aconcagua.

For about three miles the road led between cultivated fields and farm-houses, and then entered on a stony mule path between two mountain spurs; thence two miles to a small bridge, across the Aconcagua, called the "Puente de Biscachas," made of two sleepers with cross-logs, and without hand-rails. Here the road from Santa Rosa crosses to join this. The river at the bridge is about ten yards wide, rapid, and deep.

At noon we stopped near the resguardo, or custom-house, on the west bank of the Rio Colorado—a stream which enters the Aconcagua from the northward. It is crossed by a bridge similar to the Puente de Biscachas. At 3 P. M., set out again and travelled on, constantly ascending and following the bank of the river, to a grove of quillais, near the Estero de las Cruces, where we stopped for the night and for work on the next day.

Crossed a stream near a place on the bank of the river called "El Salto del Soldado," where tradition tells of a soldier's having escaped his pursuers by leaping across the chasm in which the river-bed lies; then passed another stream on the south side. The hills on each side had increased to mountains, but were covered with vegetation nearly to their summits; the bases being tolerably well wooded, principally with quillai trees. Passed several huts and small farms, and also a short ladera, or road, cut like a shelf in the side of a steep mountain, where there is not room at the base for one. There are very few of the laderas dangerous to the traveller mounted on a good mule; but they are exceedingly perilous looking places, as the mountain on the one hand rises almost perpendicularly, and the precipice—from which there is no wall to guard one—lies on the other; while below is the rapid mountain stream, rushing along over the stones at a distance, in some places, of hundreds of feet. This ladera, called the "Ladera de los Quillais," is about six feet wide, except in those parts where the bank has crumbled away.

Near our stopping-place there are two foot-bridges suspended across the stream by hide thongs, and on the opposite side of the river is a large furnace for smelting copper ores brought from a mine near by, while on this side are two or three ranchos where beef and potatoes can be had, and also beds of ox-hides under shelter. This rancheria is the resort of smugglers from the other side of the cordillera, and the principal use of one of the foot-bridges near it, is to pass over smuggled goods—tobacco generally—when there is danger from the custom-house officers.

The occupation of the people appears to be cutting firewood for the furnaces opposite, and they bid fair in a short time to leave the country bare of the fine trees which now abound there.

They appeared to be very hospitable and polite, and invited me to share their meal; but as it was the first time I had noticed their style of eating, I preferred taking my dinner in camp. Five or six were seated around a very small table, on which was a wooden bowl of beef and potato stew; but there were neither plates nor bread, and each one helped himself from the basin with a wooden or horn spoon.

November 20.—After making a full set of observations, packed the instruments, saddled up, and at 2.30 P. M. left camp and travelled till night, when we stopped a short distance beyond the first casucha. Passed on the way several streams tributary to the Aconcagua, and also a house called the "Guardia Vieja," where was formerly the custom-house. Road always ascending, and mountains on each side tipped with snow.

The casuchas are small brick houses with vaulted roofs, built by the old Spaniards for the shelter of couriers and travellers who might be caught in snow-storms. Under the Spanish rule they were provided with shelves for sleeping on, food, and firewood; but they are now without even doors, the wood-work having long since been torn away, and the supply of provisions not being kept up. They are so dismal and dirty, that, except in cases of great necessity, travellers prefer to sleep outside.

A few miles before arriving at camp, we saw up a valley to the northward what I supposed to be a glacier—a thick shelf of green-looking ice, in a gorge near the summit of the mountains.

A number of arrieros bound over stopped in company for the night, and we were very gay.

November 21.—We were not able to start so early this morning as our companions of the night. One of the mules had strayed off, and it was sunrise before we were able to find her by dint of ringing the bell of the madrina up the valley.

At the distance of about two miles we arrived at several springs, called Ojos de Agua, oozing from the base of a high mountain on the left. Their waters are supposed to percolate through from a lake further up. Near these is the second casucha, called from the springs the "Casucha de los Ojos de Agua." Afterwards passed another on the west bank of a small stream called the Juncalillo. The Aconcagua here loses its name, being formed by the Juncal from the southeastward, and the Juncalillo, or little Juncal, from the northeastward. After crossing the latter the road turns to the northeastward, between high ranges of hills, and the ascent becomes more steep. At the distance of about two miles it reaches a steep barrier hill, running nearly across from the range on the right to that on the left, being only separated from the latter by the Juncalillo. A toilsome ascent of half a mile on the right flank of this brought us to the Casucha del Portillo or "del Alto de la Laguna," near which there is a singular sandy plain, half a mile long and a quarter broad. Here we stopped for another set of observations. There is in the vicinity no other vegetation than a few low thorny shrubs, with very thin pasturage on the skirt of the hills.

Wind strong and clear from the westward, and day clear till near sunset, when the sky became overcast with thin clouds which reflected the sun's light to the snow on the mountains, tinging it with a beautiful rose-color.

The little valley in which we stopped is perfectly level, and, from the appearance of the huge and shapeless rocks that partially surround it, looks as if it was once the crater of a volcano and afterwards a lake, until the wash from the hills filled it up.

About two miles north of it there is a beautiful mountain lake, situated in a valley formed by two ranges of mountains and a hill crossing from range to range. As it has no outlet, its waters are supposed by the arrieros to ooze through the high range to the westward, and issue at the Ojos de Agua. On a clear day it has the transparently blue color of the sky, and trees and vegetation only are wanted to make it a most romantic-looking spot.

Here, for the first time, I attempted to make use of my tent. It was one of my own invention, intended to shelter the instruments from the sun while at work, and myself, during bad weather, or at night; but, unfortunately, it turned out to be a failure, and of no value for one purpose or the other. The pole was too long to be carried on the mules, and the amount of surface exposed to the wind too great for its stays to prevent it from being blown over.

We made our fires at nightfall with mules' dung—the best fuel to be had; and as the wind was strong in squalls, our stew was pretty well seasoned with the ashes. These, however, are things to which one becomes accustomed.

All that we saw of animal life, to remind us of the valleys of Chile, were small birds resembling sparrows in size, form, and color; the only difference being that the males had top-knots and a stripe of orange-colored feathers around their necks. They were very tame, and hopped about picking up crumbs within a few feet of us.

November 22.—Concluded my work in the calm of the morning, and at 7 o'clock set out for the Cumbre, or summit of the range, where we arrived about 10 A. M.; but found the wind so strong that it would have been impossible to set up the instruments; we therefore retraced our steps across the snow to the Casucha de la Cumbre, about half a mile from the pass.

The road from the Alto de la Laguna, after ascending a tolerably steep hill to the right, continues for about three miles up a valley not very steep or stony, passing, about half way, the Casucha de las Calaveras, and arrives at the foot of the steep part of what may be called the spine of the cordillera. Here there is no longer a stream to follow, but the ascent must be accomplished by zig-zags up the ridges. This is necessarily a very slow process, and frequently one finds himself but a few feet advanced after toiling over a great deal of ground.

On this morning we passed, for the first time, several patches of snow in the road, but none of

great magnitude until we commenced to ascend the Cuesta de la Cumbre, where in one place we had to cross a field a third of a mile wide. This was already undermined by the melting snow from the more exposed places above, and our mules frequently sank into it so deep as to make it very difficult to extricate them. It was necessary for us to dismount and feel our way on foot, and in this exercise I experienced, for the first time, what is called the puna—a difficulty in filling the lungs in consequence of the rarity of the atmosphere. This is frequently accompanied by partial blindness and vomiting. My attack, however, was very slight, merely causing a necessity to halt and pant every fifty yards or so.

We found in the snow a stray mule, belonging to a train that had passed over early in the morning. He was unable to get out, and would probably have died soon; at all events, two or three condors appeared to think so, as they were hovering around him in close circles, evidently expecting a feast. We extricated him and carried him along with ours.

The casucha where we stopped for work is situated on a little knoll which was sticking out of the snow, like an island. It is a sufficiently inappropriate place for magnetic observations, as the cold wind whistles around the corners with such violence as to jar the instruments, and render it necessary to make duplicate measures. There was no better place to be found, however, and I therefore set to work. The mules were unladen and sent down in charge of the peon to where pasturage could be found; the arriero and myself remaining at the casucha. As much of the work as possible was completed before dark, but enough remained to detain us till next day.

I have rarely passed so uncomfortable a night, nor one, at the same time, more impressive. My face and hands were blistered by the sun and chapped by the cold winds to such an extent as to produce fever, and I found it impossible to sleep. Nor did the arriero appear to be any better off. He was troubled with what he called the "whiffles," which he attributed to drinking a cup of tea. What the disease is I do not know, but it kept him awake; and so we both got up, made a fire of the tent-pole, and passed the greater part of the night in conversation. I volunteered two or three stories to pass away the time; one of which was so very good that I am sorry it cannot be given here. At least Joaquin—the arriero—thought so, for he did not recover from it for a long time. Occasionally, as we were riding along the next day, I would see him check his mule and wait for me to overtake him, when he would ask me a question bearing on the pith of the story; but, without waiting for an answer, would trot on ahead again, whickering to himself with great satisfaction.

From time to time our conversation would be interrupted by hearing hoarse shouts on the eastern side of the mountain, and pretty soon we would see a long line of cattle coming over the summit. On they would come at a slashing pace, followed by ten or a dozen swarthy looking centaurs, shouting and stoning them to the path. In a moment the casucha would be surrounded by them, and then down hill they would go again, helter-skelter and heels over head; their drivers only stopping for a moment to light a cigar, or inquire about the condition of the road below, and very soon we would be left to the dismal silence of the cordillera.

There also passed a small train, consisting of some twenty mules, twelve of which were laden with tobacco, intended to be smuggled into Chile. The owners of this were very particular in their inquiries about the custom-house officers, and went on apparently satisfied with the information they had gained, for which they had but little reason, as the sequel proved.

The night was so beautifully clear that I had the curiosity to set up the theodolite and turn on Saturn. With its little telescope—only twelve inches long—I was able to make out the rings clearly.

Besides the road by which we ascended the spine of the mountains, there is another that branches off about a mile below the casucha and curves the summit farther to the northward. The descent on the eastern side by that is better than by this, but it opens later, and at the time we passed was impracticable.

November 23.—Finished work and started for the summit. Having arrived there, we were

on the dividing line between Chile and Mendoza, and even from this point a difference could be noted. There was no snow in the road on the eastern side, nor was there but little on the hills; and there appeared to be a total absence of those green grasses and mosses which were in sight not far down on the Chilean side.

The height of the pass is twelve thousand feet above the level of the sea.

On the eastern side the road is very steep for about three quarters of a mile, when it arrives at a valley down which runs a muddy streamlet, called the Rio de las Cuevas, on whose bank there is a casucha. When we passed there were around this a great number of skulls and bones, the remains of a large drove of cattle which was caught in a heavy snow-storm on its way to Chile.

Turning more to the eastward after passing the casucha, though descending but little, at the distance of about three miles we reached the brink of a steep descent, at the bottom of which is another casucha. Afterwards entered on a more smooth road, leading down a uniform valley; the hills on each side being covered about half way up with thin pasturage, on which a number of guanacos were browsing. They were the first I had seen in the mountains.

Continuing along the north bank of the Rio de las Cuevas, passing several streams on either hand—the principal of which is the Rio de los Horcones, that issues from a deep valley to the northward, and also passing a natural bridge across the Cuevas, called the "Inca's bridge"—we arrived at the "Casucha de las Puquios," where we again stopped for work. Up the valley of the Horcones is seen an enormous mountain, which I supposed to be the volcano of Aconcagua, but it is called by the arrieros La Torlosa.

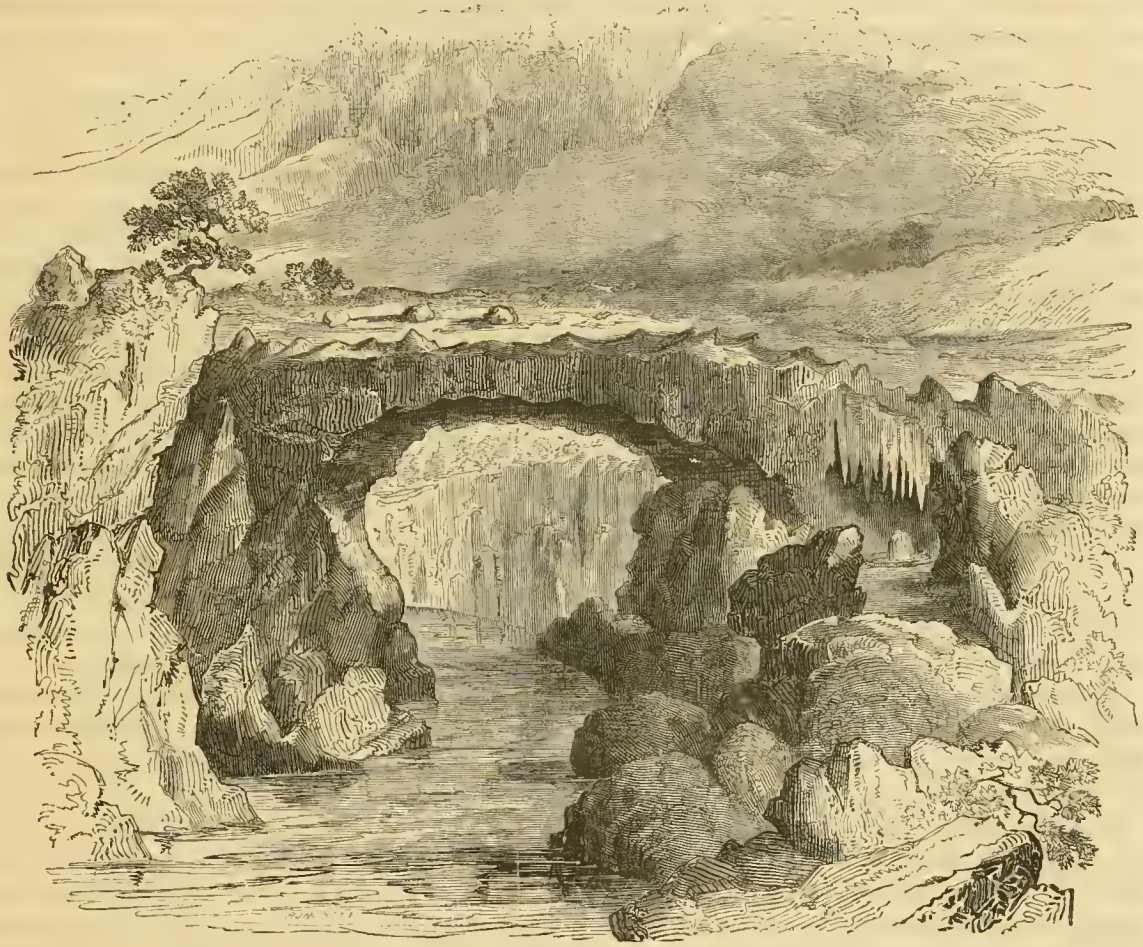
While at this casucha Mr. Blanchard, late French consul to Valparaiso, accompanied by a Cordovese and several peons, overtook us; they were bound across the pampa, and desired to make arrangements for us all to travel together, but unfortunately their baggage had gone on ahead, and they could not pass the night with us; so we parted company, promising to meet in Mendoza.

The evening of the day of our arrival and a part of the next was sufficient for me to complete my work, though it was done under the usual disadvantages of a strong wind and in the sunshine; but we determined to remain until the following morning, because there is no other place between the casucha and Uspallata, except the Punta de las Vacas, a few miles farther on, where pasturage can be found free from a poisonous weed, generally fatal to cattle. An additional reason for our remaining was, that there was near the casucha a small marshy stream of good water, which is unusual on that side of the pass. A singular difference exists in this respect between the two sides. On the Chilean, I do not recollect a single stream whose waters are not clear and pure; while on the Mendoza side there are only two or three that are not muddy, and charged with salt and lime to such extent as to be unfit to drink; the small streamlets generally having their banks covered by a thin, white deposit or efflorescence called by the natives salitre—literally saltpetre—but it is not pure. It appeared to me to have the taste of a mixture of salt, soda and lime.

Early on the first night of our stay here, one of the contrabandistas who had passed us on the Cumbre arrived in a very melancholy mood, and informed us that they had lost nearly all their tobacco. It appeared that after they got down on the Chilean side to what was considered dangerous ground, one of the party, an old and experienced hand, was sent ahead to reconnoitre and make signal to them on the appearance of danger. The custom-house guard to the number of about eight men, with an officer, had by some means got notice of the expedition, and were in ambush at a part of the road where the look-out must necessarily lose sight of his companions. He arrived at a point of hills, made signal of the coast being clear, and was proceeding to the next point, when the guard took possession of him and carried him out of sight. The rest of the party, not suspecting danger, came on and likewise fell into the hands of the guard, with all their animals and tobacco, except what was on two mules some distance behind. They had time after the surprise to unload these, and hide their loads among the rocks. Every

attempt was made to bribe the officer in charge, but without effect; and I inferred from the conversation between the smuggler and my arriero that he would be assassinated, as one of his predecessors had been, for being too honest.

The hospitality of the arrieros appears to be worthy of remark. Several men stopped here by our fire, as elsewhere, to warm themselves, chat or smoke, and there was invariably prepared for them, without asking, the best meal our fellows could offer; and as this attention was received as a matter of course, I conclude it is a general custom.



Inca's Bridge.

On the 24th, after finishing work, I rode back to the Inca's Bridge to examine it more fully, and to bathe; the latter being very necessary, as I had, by advice, allowed the dirt and grease to collect on my face and hands to prevent them from chapping.

Mr. Darwin says that the bridge was formed by the stream breaking through underneath; but without pretending to controvert his opinion, appearances justify the belief that it was formed by the concretion of the water from several calcareous springs in the hill-side, which may have gone on forming shelf after shelf, until they reached across. Such a process is now going on.

The length of the bridge is near sixty feet, its width fifty at the northeast end, and seventy at the southwest; and its height above the river is about forty feet. On a shelf of rocks under it are two boiling springs, which have been hollowed out so as to form baths. The water of these has a temperature of 97° Fahrenheit, and tastes like soda-water: the arriero said it was purgative; but I drank a quantity, and experienced no other effect than increased appetite. While bathing in the spring, I occasionally got my face into the vapor jetting out with the

water, and found great difficulty in breathing, although there was little or no smell of sulphur.

Another place worthy to be seen near the Casucha de los Puquios, is a hill called the "Cerro de los Penitentes," from the appearance of several isolated and turret-like rocks on it. Seen at dusk when the outlines only are distinct, this hill has so perfectly the appearance of a castle as to deceive any one who did not know that he was beyond the limits of all castles.

Considering the breaking of my aneroid barometer as my first misfortune, the second happened here. I took the chronometers out, and wound the two silver ones; but as the gold one had such a highly burnished case, I stopped to examine in it, as in a mirror, the condition of the sores formed on my nose by the sun. The inspection was interesting, and led to so long a train of thought as to whether my friends would recognise me, that I eventually forgot to wind it, and the next morning found that it had run down. The only remedy was to make another set of observations, and trust to the chronometer taking up its old rate from the start. It was the only reliable time-keeper I had.

On the evening of the 25th we again set out, greatly refreshed by the resting spell. A distance of about seven miles down a straight valley bounded by nearly uniform hills, brought us to the Punta de las Vacas, near which, on the southern bank of the river, is the last casucha; and on the left of the road are the ruins of a stone hut, formerly the Guardia, or toll-gate. Vegetation became more abundant and varied as we descended. Besides the thin grass and weeds we had seen before, there were two classes of low bushes; one, somewhat resembling myrtle, is, I believe, called the Chilca, and the other Jarilla. The latter was in bloom, its leaves and flowers being arranged in palm-shaped branches, and the flowers almost invariably towards the eastward, probably for protection from the wind, which is generally from the opposite direction.

After passing the ruins of the Guardia Vieja, the road crosses the Punta de las Vacas, and at a short distance is in front of one of the finest views in the cordillera. To the southward is a long valley, down which flows the Rio de Tupungato, a stream tributary to the Cuevas, taking its rise at the base of a majestic mountain called Tupungato. (See wood-cut, opposite.)

This appears to lie midway between the two ranges bounding the river, and to block up the valley at that point. Its summit is nearly hemispherical in form, and covered with perpetual snow, and there is a quiet grandeur about it, as seen from this place, far exceeding anything else in this pass.

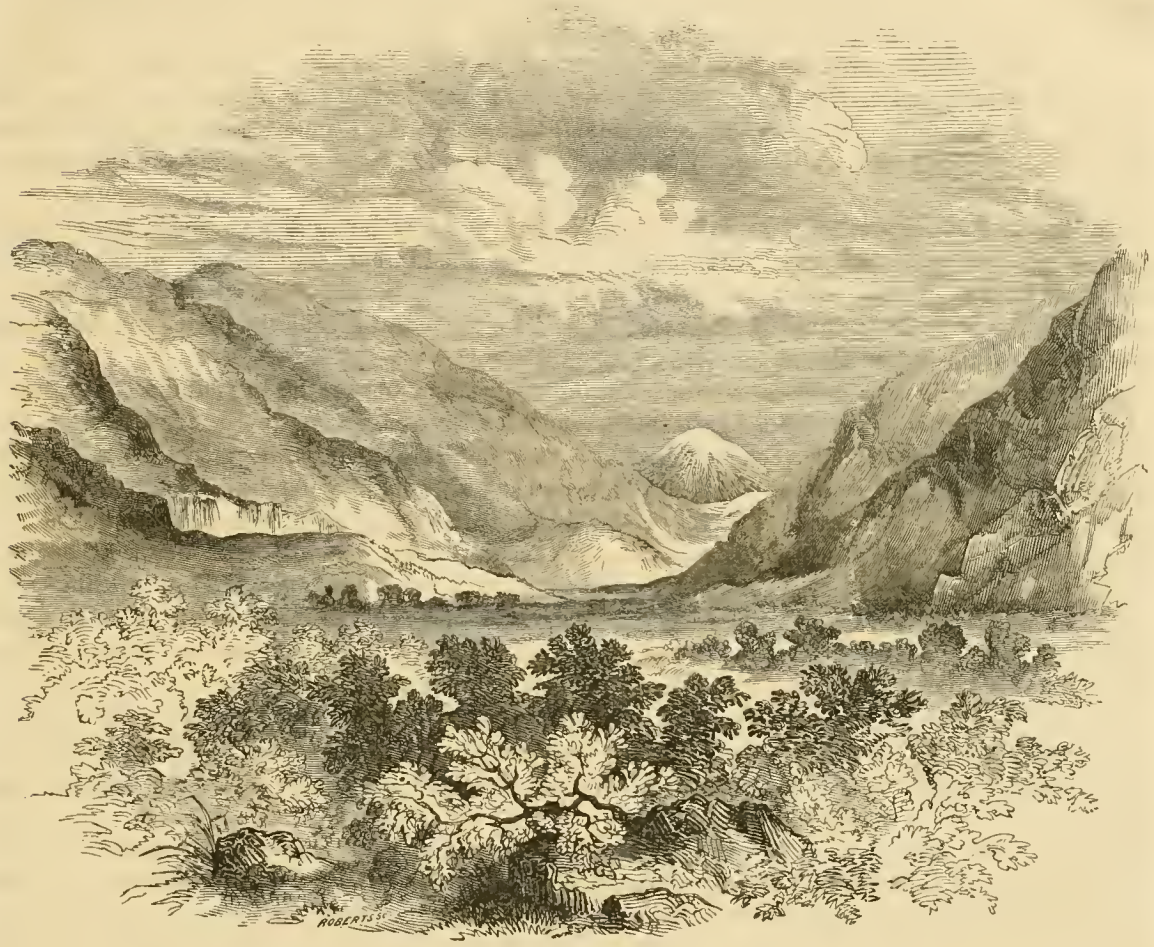
A short distance from the point we forded the Rio de las Vacas, the most formidable stream, not bridged, in the mountains.* At its junction the main stream loses its name, and from the Rio de la Cuevas becomes the Rio de Mendoza. Crossed the Ladera de las Vacas, and arrived at the Peñon Rasgado. This is a large rock, split both latitudinally and longitudinally, which, like a quartered orange, appears to be on the point of falling apart. From here to the Ladera de las Polvaderas there is nothing worth noting. There is, or was, in this ladera a very startling place called La Caleta. The path sweeps up the skirt of a hill, which at the commencement is not very precipitous on one hand or the other, but at the distance of about a third of a mile it becomes almost perpendicular, and just in the worst part the road turns abruptly behind a large rock and enters a few paces into the mountain. Overhead is a jutting rock, which, although high enough, does not appear so, and the rider mechanically dips his head to avoid contact. After passing this, there is an immediate descent, by a few rude steps cut in the mountain; and before one is aware of it he is again out of the cave, and on the brink of a precipice near two hundred feet deep.†

Farther on there is another ladera called Las Cortaderas, which has also its dangerous part; being cut into the hill, so that it looks like a tunnel, except that it is open towards the river.

* I learned that a bridge was being made for this stream in Mendoza, and, on my second trip in the following year, found an excellent one erected—the work of my friend, Colonel Rivarola.

† On my second trip, this place was so much improved as to be no longer formidable.

While we were adjusting the girths of our saddles, the two burden-mules went ahead, and met a train descending in this tunnel. To pass each other was impossible, and we were all alarmed lest they should be knocked over the precipice. They succeeded in turning, however, by bringing all four feet close together and poising themselves beautifully on the brink of the road, and then came trotting back, apparently as much relieved as we certainly were.



Valley of the Tupungato.

I do not think I was ever more provoked by the want of knowledge on the part of the arrieros as regarded distances, than I was this day. At the time of starting from the Casucha de los Puquios, I was informed that we would go but a short distance and take our meal at the river Pichiuta. My habit was to provide myself, before setting out, with crackers to nibble on the way; but this morning, in consideration of the short distance, I had neglected it. By noon I was quite hungry, and, on inquiry, I was told that we were near the Pichiuta, whose locality the arriero indicated by sticking out his chin and saying: "Un poco mas allá, al otro lado de aquella lomita"—a little farther on, on the other side of that hill. As the hill was near, I resisted the gnawing of my stomach for a while; but lost patience after passing not one, but a dozen lomitas, and asked the peon to point out the exact place where we were to stop. He showed me a hill some ten miles off, and said the Pichiuta was just this side of it. As it was now four o'clock in the afternoon—more than twenty-four hours since our last meal—I ordered a halt; and we got a pot of charqui soup, made from the muddy and disagreeable water of the Mendoza.

Two hundred yards farther on we arrived at the Pichiuta, a fine stream of clear and excellent

water, with pasturage and fire-wood in abundance—altogether a delightful spot for an hour's resting-spell.

The traveller will save annoyance by not asking distances of the arrieros. They have no idea at all, except what is based on the condition of the road and of the animal on which they may be mounted. To them, with a good horse on a good road, a place is very near which is very far off, on a bad horse or road. Their "allá no mas," (just there;) or "alla-cito," (a little this side of just there;) generally turns out to be as far as the eye can reach.

From the Pichiuta to the table-land there is very little worthy of note. Vegetation increases; several streamlets enter the river from one side or the other; and the mountains decrease in height. On entering the table-land near Uspallata, we left the Rio de Mendoza, which flows off to the southeastward, and at the distance of about seven miles reached the river and hamlet of Uspallata.

On our way we saw a beautiful false sunset. The sun was below the summits of the main range; but some scattered clouds, high overhead, intercepted in part its last rays, and the bright and dark streaks of atmosphere converged in the distance to the eastward till they appeared to come to a focus at the summit of the range separating Uspallata from the plain, presenting a perfect appearance of sunset in that direction.

Uspallata is merely a rancheria, consisting of low adobe houses built round a court-yard. The principal part of it is divided into small rooms for the accommodation of travellers; these have no other furniture than one chair and a very small table in each. Here, as in all the post-houses across the country, the bed-place consists of a shelf of adobes against the wall, raised about two feet above the level of the floor; this is generally whitewashed, but is not covered, even with ox-hides—the general bed of the traveller—it being supposed that he has blankets and sheep-skins enough about his saddle-gear to furnish a couch. The building also contains the "guardia," or deputy custom-house, the few soldiers belonging to which are quartered in a little detached shed. These are militia, draughted for duty by the month, during which time they receive a real, or twelve and a half cents, per diem.

Around the houses are several large pasture-fields, planted in clover, for the use of cattle and mule trains. They must yield a large revenue to the proprietors, as the price was, I think, eighteen and three-quarter cents a head per diem; and on the night of our arrival, the place was alive with mules and horses.

On the following morning I saw illustrated, in a most striking manner, the great value of the madrinas, or bell-mares. Before daylight the arrieros were out preparing to start; and as there were half a dozen trains—some bound east and others west—I supposed it would be very difficult to separate them. On the contrary, it was the easiest matter in the world; each arriero led off his madrina, tinkling her bell, and in a moment the different troops parted and followed after their respective leaders. For this reason the arriero regards the madrina, or rather her bell, as the apple of his eye; for, although his mules readily follow the bell on another mare, they will seldom follow the mare with another bell.

The animals most readily trained to this, or, as it is called, "amadrinado," are the offspring of mares and jacks; those of jennets and horses being apt to leave the drove when there are horses in sight, appearing to prefer the company of the latter to that of mules.

The mule I rode was perfectly amadrinado, and gave me no little trouble whenever I wished to stop for a while to make a note. I found it necessary on such occasions to make the arriero dismount and hold her; for as soon as the bell-mare was out of sight or hearing, she would become exceedingly troublesome, kicking and jumping to an alarming extent, and when turned loose would be off at a gallop to join her companions. This is universal with well-trained animals.

The river of Uspallata is about six yards wide, knee-deep, and clear, and its water excellent. In it there are quantities of small crabs of a very singular form, and a few little fish resembling cat-fish.

On the morning of the 27th we again set out; and after travelling about fifteen miles to the northeastward, along the skirt of the Uspallata range, and gradually ascending, we reached its highest point, called "El Paramillo" *par excellence;* for although there are several paramillos—places exposed to the cold winds of the mountains—this is perhaps the most exposed of them all. Here we fell in with the tail of a snow-storm, which prevented me from seeing anything more of the nature of the country than that the hills were higher on both sides than in the road.

From this we turned to the southeastward, and commenced to descend by a steep and narrow valley with high hills on both sides. Passed two mining establishments, one on the right and the other on the left. I believe they are not worked at present; the few peons employed about them only picking out enough grains of gold to cover their expenses. Passed also, on the left, a high bronze-colored hill called the Cerro Dorado, or gilded hill; and finally, after a ride of nine hours, arrived at the high-sounding, but wretched place, Villavicensio. The name indicates a town, but there is really nothing more than one long hut, divided into two parts, with an adjoining shed for a kitchen. The room for travellers is without any furniture except a small table and a couple of knotty logs on crutches for seats. Its floor is of earth, and at the time of our arrival the rain had leaked through the roof to such extent, that it would have served better for a brickyard than a chamber. Add to this, that we could get nothing to eat but bad beef and four eggs, and you have a description of Villavicensio as I found it—a place rendered notable from the fact that the wife of an English traveller was here confined and delivered of a child. How she managed to exist through such a complication of miseries is a mystery. If it had been a man, accustomed to all hardships, it would have been a small matter; but for a delicate woman to be confined in such a place must have been the acme of misery.

Upon consultation with the arriero, who was as little pleased as myself with the prospect of a night's lodging there, I learned that the mules would be capable of going on as far as Mendoza, and after allowing them to graze for a couple of hours we pushed on.

A short distance down the valley brought us in sight of the plain, spreading out with unbroken horizon from north, around by east, to south. Its appearance is generally like that of the ocean; but on this occasion it was particularly so. The sky was entirely overcast, but some reflected light fell on the nearer part of the plain, giving to it the appearance of shoal-water. Far in the distance to the southward, Mendoza, with its tall poplars, was in sight, requiring no stretch of imagination to fancy it a port with shipping; while, rising above the horizon to the eastward, were the peaks of a remote range of hills, finishing the picture in their resemblance to islands.

On emerging from the mountains we were saluted by the familiar notes of the partridge and mocking-bird, giving us assurance that we had arrived at habitable regions.

I think the mocking-bird very much slandered by those who suppose it to have no notes of its own. Here, and elsewhere in those parts of the plain where there are woods, it is common, and has many of the same notes that it has in the southern parts of the United States; and it certainly has no originals to copy from hereabouts, the country being remarkably destitute of warblers.

By nightfall we were in the well-beaten road, and being desirous to enjoy the luxury of a bed under shelter, I left the party behind and pushed on alone—a step I had reason to regret, as the distance was so much greater than was anticipated, that I believed I had lost the way; but at length the outer settlements of Mendoza were discovered, and two drunken gauchos informed me that I was on the right course. One of them was disposed to be very familiar, and leaned on my mule to hold a conversation, which I cut short by spurring ahead and leaving him sprawling in the road. Of course I was saluted with very complimentary epithets, which, as I was out of reach of their knives, I cared very little for. I should not have been guilty of this great discourtesy, but that I was badly scared. It was a late hour and a lonely place; and

MAP

of Part of the

ARGENTINE REPUBLIC

Showing the Courses of the Rivers

on the road to Chile.

Explanations

- ✪ denotes a capital town
- ● small town
- ○ collection of ranchos
- • post house or single rancho
- ---- the road from Buenos Ayres to Chile
- Sectional elevation above the sea exaggerated 20 times

Engr. by Selmar Siebert

the gaucho who wishes to commit robbery or murder generally comes close up, assumes a familiar manner, asks for a cigar or light, and before the victim is aware, whips his knife out from under his poncho and accomplishes his purpose.

After arriving at the town, I was as badly off as when in the country; it was half-past one in the morning, and the streets were completely deserted, so that there was great difficulty in finding the hotel. By good luck another drunken man turned up, who, for a consideration, showed me the way; and finally, after a ride of eighteen hours, or thirty leagues, I alighted, completely knocked up. The worst of it was that I could not get a bed, nor anything to eat or drink, and had to put up with saddle-cloths on the brick floor till next day. The men with the mules arrived at 6 A. M., and were paid off; and here ended the first part of my journey.

The principal streams passed in the cordillera are the following—commencing at Santa Rosa: 1st. The Aconcagua, whose width where it is crossed by the Puente de Biscachas is about ten yards. It is there deep and rapid. 2d. The Colorado, from the northward, which is ten yards wide, and not fordable. 3d. The Rio de Gualtatos, from the southward, ten yards wide. 4th. The Rio Blanco, from the southward, six yards wide. 5th. The Rio de los Hornillos, from the northward, crossed by a bridge. 6th. The Rio del Peñon, from the northward, five yards wide. 7th. The Joncal, from the southeast, at its junction with the Joncalillo, where the road leaves it, is about ten yards wide. 8th. The Rio de los Horcones, from the northward, about six yards wide. 9th. The Tupungato, from the southward, eight yards wide. 10th. The Rio de las Vacas, from the northward, ten yards wide. 11th. The Pichiuta, four yards wide. All of these streams are very rapid, and the quantity of water discharged by them depends very much upon the season of the year and the hour of the day. In the spring, when the snows begin to melt, they are full; and many of them which are insignificant early in the morning, are very formidable after mid-day. They are all tributaries either to the Aconcagua on the west side, or the Rio de Mendoza on the east.

Of wild animals, I saw only guanacos, foxes, and mountain rabbits about the size and color of rats.

Of birds, the little sparrows and the enormous condors are the most common; but there are also mountain partridges, ducks, and a few hawks.

The weather during our journey was exceedingly favorable. From our departure from Santiago, till our arrival at Uspallata, we had clouds part of one day only. The wind generally sprang up about six o'clock in the morning from the westward, and by nine was blowing half a gale. Near nightfall it would again die away, and generally during the night there was a light counter breeze from the eastward. In Uspallata, and from there to Mendoza, we had southeast winds and cloudy weather, with a fall of snow in the mountains.

CHAPTER II.

MENDOZA.

PLAN OF THE TOWN.—ALAMEDA.—SANJON.—BRIDGES.—CHURCHES AND CONVENTS.—STYLE OF BUILDING.—CHEAPNESS OF LIVING.—GOVERNMENT.—HEALTH.—GOITRE.—AGRICULTURAL RESOURCES.—NUMBER OF CATTLE SENT TO CHILE.—CRIMES.—DEMOCRACY OF THE BILLIARD ROOM.—MARKET.—MODES OF CROSSING THE COUNTRY.—GALERAS.—TWO-WHEEL CARTS.—OX-CARTS.—MULE TRAINS.—POST HORSES.

Mendoza contains a population of about nine thousand. It is laid off in squares of one hundred and forty English yards each; the streets running nearly north and south, and east and west. One or two of these appear to have been paved in former times, and all have very narrow and uneven sidewalks. The western part of the city is bounded by the Alameda—a fine walk shaded by poplars, and furnished with stone sofas at convenient distances for the use of promenaders. On the evening of feast days a band of music plays here; and this, with the facility of getting ices—of which the Mendoçinos are passionately fond—from two or three cafés near by, attracts nearly the whole population. Horsemen are excluded from the walk, but congregate in front of the cafés, and enliven the time by running short races down the road, which is separated from the Alameda by a canal or ditch cut from the Rio de Mendoza. This, and another canal called the Sanjon, are at nightfall the common bathing places of the population. Sir Francis Head states that he saw here men, women, and children, in a state of nudity, bathing in common. Such may have been the case when he passed, but I certainly saw no indecent exposure except on the part of small boys, who I believe are the same in that respect everywhere.

The Sanjon is in the eastern part of the city, and separates it from a suburb called La Chimba. Across it are two bridges, one square apart; the smaller of which is of wood, on brick piers, and was built by a governor by the name of Molina, whose fame is commemorated on its columns in rather a singular manner. Near the top of each is one large letter of his name, and below on tablets are records of some of his good qualities or acts, to read which the large letter above is necessary, thus forming a kind of acrostic. The other bridge was built afterwards, in a spirit of emulation, by one of Molina's successors. It is of masonry, very neat and firm, and its columns also serve as monuments of departed heroes, whose particularly praiseworthy acts or qualities are there recorded.

The banks of the Sanjon are thickly covered with roses, whose fragrance on summer evenings makes the bridges a favorite resort for the sentimental.

There are two plazas in the city; but they have nothing more to recommend them than most plazas in Spanish towns—great extent and desolate appearance. In the centre of the principal one is a dry fountain, guarded by four posts and a chain, to keep it, I suppose, from going to the river for a little water.

Of churches there are several, all of them unfinished exteriorly. There are also four convents of monks and one of nuns. The inmates of the latter I believe teach female children. The usual stories are told about the licentiousness of the friars; but, whether with good foundation or not I am not prepared to say, as I saw nothing of it.

The houses, with one or two exceptions, are of one story; the best of them being flat-roofed, but the majority having peaked roofs, thatched, and covered over the thatch with a mixture of

mud and chopped straw, such as is used for making adobes—a style of building that gives a very dull appearance to the place. Nearly all of the houses have window-sashes, though very few have glass. The government house—which, however, is a private one rented for the purpose—has, I think, but one window glazed, and in other respects has about it an air of most republican simplicity. Indeed, the same may be said of the whole place not only in regard to the appearance of the building, but also of the manners of the people. Judging from what I saw, there is very little offensive pretension to superiority on the part of those in authority, or well to do in worldly goods; and the aristocracy of dress has not progressed so far as to make a respectable woman ashamed to be seen in calico. There is, therefore, a greater feeling of equality than is usual in so large a community.

Mercantile business is generally conducted on small capital; and as living is cheap, any industrious man may maintain his position and support his family at a very small cost. I visited in one or two houses which had fronts of about sixty feet on two streets, and gardens and out-houses, covering near half a square; yet their rents were only five dollars a month, and the wages of cooks and men-servants are only about a like sum.

The salaries of public officers are very small, and there does not appear to be the same facility for them to accumulate fortunes by dishonest means, as in some other parts of South America. The people appear to have but little, or want but little; and notwithstanding they have recently been embroiled in civil wars, all party feeling seems to be extinct, and in its place they have adopted the harmless idea that Mendoza is a great city, and, from its geographical position, destined soon to astonish the world; under which belief they get along as peaceably and happily as could be desired even in Utopia.

The government is representative, but is administered at present rather by traditionary laws than by any well established constitution. Since the downfall of Rosas a general call has been made for deputies from the several provinces of the Argentine Confederation, and they are now waiting for these to form a constitution and code of laws.

In the formation of laws and enactments relating to the province, the governor has, as in Chile, the initiative; or, in other words, he proposes to the provincial congress such as he deems necessary, and instances of laws originating with the congress are exceedingly rare. Of the health of the city I could learn but little. It was very common to hear people talk of the prevalence of pulmonary diseases; but an intelligent English physician, of long practice in the country, informed me that it was their custom to call everything consumption which they did not understand, and that consumption was almost entirely unknown—the place being in reality so healthy, that invalids repaired there for the benefit of its pure air.

Goitre in its ugliest form is very common. It is said that in some parts of Europe this disease grows very symmetrically in the middle of the throat, and is considered an ornament, as it serves to display fine laces and jewels. In Mendoza it is quite the contrary, being generally knotty and on one side; and not unfrequently there are two—one on each side of the throat; but even in this case the symmetry is spoiled by one being higher than the other. There can be but little doubt that it is produced by the use of the water of the Rio de Mendoza, or rather of the Sanjon, which comes from the Mendoza, five leagues to the southward, as the disease is almost wholly confined to the lower classes, who are unable to pay for the spring-water brought in on mules. A few leagues distant, where the water of the Tunuyan is used, it is said never to originate.*

The principal cereal produce of the province is wheat, which grows well and is of good quality. Indian corn is also raised without difficulty, but not in large quantities; so also are grapes, peaches, melons, figs, and olives. Indeed, the want of a market is the great obstacle to agriculture. Flax grows readily, and is cultivated in small quantities; but the great source of revenue is the alfalfa, or clover of the country. Large numbers of cattle and horses are driven

* Doctor Day—the English physician previously referred to—assured me that he had known an incipient case of goitre in a newly-born infant.

through the province on their way to Chile, and are nearly always detained long enough to give them an opportunity of fattening and recruiting before attempting the mountain passes. These pay so much per head to the owners of the pasturages for the time they may remain. I was told that about fourteen thousand head of horned cattle, fifteen hundred horses, and six hundred mules, were sent to Chile in one year, and from observation do not think the account exaggerated. Of these, many are lost before they arrive. Some split their hoofs to such an extent that they are unable to travel; others die from eating the poisonous weeds on some parts of the road; and a few are lost over the precipices. The oxen are always shod on the fore feet before they are driven across the mountains; but notwithstanding the great care taken of them, they die in such numbers that the road from the entrance on one side to the outlet on the other is perfectly marked out by their skulls and bones.

From a pamphlet published in Mendoza I translate the following statistical information:

"Without doubt the most important branch of our external commerce is that of quadrupeds, which we carry on with the neighboring republic on the other side of the Andes. From what we have been able to gather, there have been exported across the cordillera, between the first of May, 1851, and the first of January, 1852, fourteen or fifteen thousand head of horned cattle, seven or eight hundred mules, about two thousand horses, and three hundred mares.

"That which evidently gives most increment to this interesting article of our trade, and consequently an augmentation to the public riches of the country, is the consumption and sale of alfalfa for fattening the animals sold. The province is opulent in this precious production, and will be doubly so.

"We have made a calculation from data furnished by competent persons as regards the number of cuadras—140 English yards square—of alfalfa cultivated in Mendoza, and this gives a result of eighty thousand cuadras.

"As regards cereals, Nature and the fertility of our soil spread with prodigal hand their savory treasures. This branch of our produce is of the most excellent quality, and yields considerably.

"By what the table of the annual rent of tithes furnishes we may estimate the amount of the harvest of the principal grains thus: Wheat at from ninety thousand to a hundred thousand fanegas—(a fanega contains two bushels and a quarter); Indian corn about the half, and beans about a tenth part of that quantity.

"The vintage, which has been neglected in the country, has diminished very much in its products. Nevertheless the table of rents before spoken of warrants us in computing the quantity annually made at one hundred thousand arrobas of mosto, or unfermented wine."

This last item is certainly a great exaggeration. Of crimes the most common in Mendoza is theft. Murder, except in brawls, and occasionally for revenge, is very rare; and generally speaking, the lower classes, among whom those crimes are usually confined, are a peaceable, civil, and good-natured people; but as they are fond of drink, and all carry long knives in their belts, they are sometimes awkward fellows to deal with.

One thing remarkable from Mendoza to Rosario is the perfect democracy of the billiard-room. At pool it is not unfrequent to see a colonel in the same game as the common soldier, the dandy with the loafer, or the rich employer with the ragged and dirty laborer. Indeed, the only qualification required is the necessary money to enter with, and it appeared that the poor workmen who have a fondness for billiards labored all the week to gain a few reals for the pleasure of losing it in good company on Sunday.

Besides billiards, which is the favorite amusement of the young men, card-playing is very common among the older ones. At the hotel in which I lived, every evening when the weather was good, four or five tables were set out in the patio or court-yard, and by nine or ten o'clock they would generally be all occupied by grave-looking old Dons, smoking paper cigars, sipping ice cream, and playing a dull and stupid game, somewhat like whist. Their sitting generally lasted till one o'clock in the morning, when the old codjers would toddle home.

In warm weather Mendoza is like a deserted city from about eleven A. M. till five P. M. The stores are closed, and people all retire to take the siesta, or pass the heat of the day as best suits them.

From the little I saw of the polite society of the place, I was very favorably impressed. When walking about the streets at night I could not help learning, however, that the plague of pianos was making its inroads.

The government, although hampered in its means, was endeavoring to improve the condition of the roads and bridges. A gang of hands was at work in the mountains clearing the road as far as the Cumbre, and a fine bridge was being built, under the direction of Don Carlos Maria de Rivarola, for the Rio de las Vacas. I mention this gentleman's name in order to state that he was universally kind and attentive to me, and rendered me any assistance in his power in the discharge of my duty. Through his introduction I obtained from an exceedingly interesting and amiable lady, with a charming impediment in her speech, the use of a fine shady vineyard. Here, under shelter and refreshed now and then by a rum punch or lemonade made by the lady's own hand, I was enabled to complete my work.

Don Carlos was colonel under Rosas, but for some years has been chief of the engineer department in Mendoza ; and, although never educated as an engineer, he has very excellent practical knowledge, and is quite suited to the wants of the country.

The market of Mendoza is supplied with scarcely anything more than beef, squashes, and potatoes. Chickens, eggs, and a few other articles are hawked about the streets, but are very scarce. In the hotel the cook came every day to inquire what we would have for dinner ; and in answer to our questions as to what she had, invariably said, whatever we wished ; but we soon found that we must choose only from beef or chicken, eggs or squashes.

The various modes of crossing from Mendoza to Rosario or Buenos Ayres are, first, in what are called galeras—enormous, heavy four-wheel coaches, hung like our stage-coaches, and bound and lashed around the spokes and axle-trees in every direction with raw-hide thongs, to strengthen them. In some parts of the country—as from Rosario to Cordova, for instance—these travel regularly, the passenger paying about fifty dollars for his seat, and having no responsibility for the horses or coach. But from Mendoza there is not travel enough to justify this, and therefore the usual way is for two or three to club together and purchase a galera. As to the cost, I can only give my own experience. Before we had decided how to travel, Mr. Blanchard and myself cast about us for one, but could find only one at all fit for the journey under four hundred dollars, and this was in a dilapidated condition.

Harnesses are not necessary for these or any other wheel-vehicle used in the pampa ; so that after paying for the carriage, the only other expense is for horses. These are obtained at the post-houses at the rate of one real—twelve and a half cents—per league each, except for the first post out of the towns, which are generally double rates. The galera requires four horses, each of which is mounted by a postillion. They are connected with the carriage by means of lassos hooked to the saddle-girths—two alongside of the tongue, and the other two at its end, so that it is only a momentary job to change them. When the post is long, it is necessary to have a relay or two driven in company, which, of course, increases the expenses. This is perhaps the most comfortable, although the most expensive way of travelling. It is also rather rapid, the horses being spurred along at a gallop where the road is good, and the post short.

Besides the galera there is a nondescript vehicle, on two wheels, that looks like a peak-roofed house. It has no springs, and is drawn either by horses or oxen. Next comes the ox-cart itself, an immensely high and narrow affair, mounted on very large wheels. The wood-work of this is necessarily very strong, but the sides and top are of straw, closely woven over half hoops. Each cart is furnished with a large earthen jar, strapped behind, for carrying water—a very necessary article, because in some parts of the road they are frequently two or three days crossing what are called travesias, places where there is no water to be had.

These vehicles are generally drawn by three pairs of oxen ; the first supporting the tongue ;

the others a little separated ahead, and capable of being let out to some distance when the wagon gets into a mud-hole. The object of this arrangement is, that the two front pairs may get on dry ground, where they will be able to pull the cart out. The oxen are always yoked by the horns, which I do not think preferable to our way. The driver of one of these ox-carts sits in front, armed with a short goad for the first pair of oxen; and has control of another long enough to reach the head pair, which is slung from the roof of the cart in such a manner as to be nearly balanced. This is armed with an iron point at the extremity, and has another projecting from it at right angles in such a position as to reach the middle pair. Their rate of travel is from three to six leagues a day; and this mode can recommend itself only to a naturalist or to a person fond of hunting. Either of these could have a horse along, and whenever he should get tired of the cart, could mount and gallop off in any direction as far as he pleased, with a certainty of being able to overtake the train by night. I thought of taking a cart for myself and instruments, making it comfortable by half filling it with straw, and learned that it would cost me sixty dollars to Rosario; but I had to decline, as the owner of the train would not consent either to my going ahead or remaining behind—which would have been necessary, as the trains do not halt long enough to accomplish the work I had to do.

Simple passage in a cart from Mendoza to Rosaria is usually from seventeen to twenty dollars, beef included; but the passenger must accommodate himself in the best way he can on top of the load. The time of travel between the two places ranges from thirty-five to forty-five, and even to sixty days, depending on the state of the road.

These are the only modes of travel across the pampa by wheel conveyance; but there are still three others more usual than either. First, by hiring one mule, or as many as may be needed, of a train bound over with produce. In this case, you put yourself entirely under control of the capataz, or chief arriero, setting out and stopping when he pleases. The expense is generally very small, but is not at all fixed, and the proper price will be about what the shipping, or rather muling merchant pays per load, which, I think, is not far from fifteen dollars. A stranger, however, will, in all probability, have to pay more; and if he travel in this way, it will be well for him to have a native servant, accustomed to the ways of the road, who should be made to provide fresh provisions, whenever they can be had, and carry along a keg or a couple of bottles of good water, which must only be used in case of necessity: otherwise he will be obliged to put up with one meal of charqui a day, taken, probably, at a pond of stinking water. The arrieros generally carry water in a pair of large ox-horns, called *chifles*, which are hung over the crupper of the saddle; and it is almost unnecessary to say, that after riding six or seven hours in the sun, with the additional heat of one's thighs on them, the water, however good when first put in, is sufficiently disagreeable. Taking everything into consideration, I think this the most inconvenient way of travelling. I met in Mendoza a small party of half-starved Italians: they had come from Rosario, with a train of mules partially laden, for the small sum of eleven dollars each, including beef on the road; and their complaints of suffering for want of proper food and water were lamentable. I can answer, from experience, that the idea of a person who has been brought up to some of the luxuries of life being able to jump, without preparation, into the habits of the people of the pampa, is almost, if not quite, as preposterous as for him to say, that because cattle subsist on pasturage, he can, Nebuchadnezzar-like, live on grass also. It requires a special dispensation of Providence for him to come out safe.

The difference between the prices of taking mule trains from Mendoza to Rosario, and from Rosario to Mendoza, consists in the fact that the first trains take down cargoes of greater bulk than they have on their return, and that mules are much cheaper in Rosario than in Mendoza. Therefore the capataz of the downward train will take the least number of animals possible, knowing that, if any fail, he can purchase and make a profit on his return. Next to hiring mules belonging to a train, is to agree with an arriero for the requisite number of animals, both biped and quadruped, stipulating that they shall be entirely under the traveller's control. In this case, one may go when and where he pleases, and, of course, must pay accord-

ingly. It is difficult to say what the price ought to be in such a case. When I was looking about me for a conveyance from Mendoza to Rosario, the best arriero in the place offered to take me, with two loads of baggage, under the above stipulations, for the sum of one hundred dollars; and I was led to suppose that he would eventually agree for seventy-five, which I had offered. Probably when there are two or three persons together, with a tent and some necessary small stores, this, after the galera, would be the most comfortable way of travelling, because one becomes accustomed to the men, and, what is more important, to the horse or mule he rides, which is not the case in travelling by post—the last to be mentioned of the several modes of crossing the country.

To go by the post does not imply, as one would suppose, going with the mail, and obliged to keep pace with the courier. It merely means that, by paying a certain tax for a certificate from the *administrador de correos*, or postmaster general of the province, you are authorized to call at the post-houses and demand of the master of the post the number of horses stipulated in the certificate, which he is bound to furnish at a fixed price. The privilege is granted to the master of the post, in consideration of the advantages he derives from the traffic, which is not inconsiderable in a country where the wages of a postillion rarely exceed five dollars a month, and the value of horses is almost nominal. With the exception of the first post out from the seat of government of a province or department, which is charged double, the price per league is six and a quarter cents for a saddle-horse and twelve and a half for a carriage-horse. In some of the provinces, the charge for burden-horses is the same as for saddle-horses, and in others double. I paid twelve and a half cents in Santa Fé and San Luis, but in Cordova and Mendoza only six and a quarter. The horse ridden by the postillion is also paid for by the traveller, who will find it to his convenience, if he be in a hurry, or encumbered with but little baggage, to pack his things in a soft valise, which, if not too large, is carried by the postillion across the crupper of his saddle. In this way I have seen them carry valises at least three feet long and one thick, for which they did not receive a cent beyond the six and a quarter cents per league for the horse on which they rode.

Provided with a certificate from the administrador, for which he has paid one dollar, the traveller goes to the post-house and notifies the master of the post at what hour he wishes to have the horses, and they are brought at the stipulated time. He may then go to the next post-house leisurely or at a gallop, as he pleases; and, on arrival, may either call for horses immediately or wait any length of time he wishes.

It is advisable, if one wants good horses, to fee the master of the post, and a feeling of generosity will generally suggest a small gratification to the postillion who accompanies him; but for the purpose of obtaining good horses, feeing the postillion is of no use whatever, because he is generally occupied preparing for the ride while another is catching them.

The great inconvenience attending this mode of travel is, that one hardly becomes accustomed to his horse before it is necessary to change; and if there is a burden-horse along, the postillion from one post may be perfectly versed in arranging the load, and the one from the next know nothing about it, so that if it begins to turn on one side there is a deal of trouble to get it straight again. Besides this there is another inconvenience. Every man or boy in the pampa rides as if he was born to it—which is in reality the case—and they have a thorough contempt for any one who does not ride well; so that the chances are rather more than even that the inexperienced rider will have the most vicious horse in the drove palmed on him, and if he does not get a fall before arriving at the next post it will be little short of a marvel.

CHAPTER III.

FROM MENDOZA TO SAN LUIS DE LA PUNTA.

LEAVE MENDOZA. — OUR PARTY. — CHACRA OF THE ALDAOS. — HOSPITALITY OF THE SEÑORA. — WATER OF THE TUNUYAN. — LA RETAMA. — SAN ISIDRO. — LOMBARDY POPLARS. — SANTA ROSA. — A FALL. — RIVER TUNUYAN. — ACOROCORTO. — MISHAPS. — POETRY OF THE PEONS. — DESAGUADERO. — LAS TORTUGAS. — LOCUSTS. — REPRESA. — VIEW OF THE CORDILLERA. — THE BEBEDERO. — EL BALDE. — THE REPRESA. — ARRIVE AT SAN LUIS. — AN ENORMOUS NOSE. — SEPARATE FROM MY COMPANIONS. — PORTRAIT OF DON MANUEL. — SAN LUIS. — POPULATION. — GENERAL APPEARANCE. — SOLDIERS' COSTUME. — HEALTH. — HOTEL. — MISTAKE OF THE COOK. — CULTIVATION. — COCHINEAL. — GOLD MINES.

On the 7th of December I left Mendoza in company with Mr. Blanchard, a Cordovés by the name of Figueroa, and young Aldao, the owner of a small train of mules with which he was going to the Rio Cuarto for a drove of cattle. He contracted to take us that far at the rate of six dollars per mule, and in addition furnish us with beef.

Our first stage out was made in a nondescript vehicle loaned to Mr. Blanchard by a friend, in which we proceeded about ten leagues and stopped at the estate of the Aldaos, where we were received with great hospitality by the mother.

For nearly the whole distance the road leads between rows of poplar trees, bounding wheat-fields and pasture-grounds, with houses and grog-shops occasionally. Passed two places marked "Rodeos" on the map—the "Rodeo de la Cruz" and the "Rodeo del Medio"—which, from their high-sounding names, I supposed meant towns or villages; but they are merely convenient places for carts and trains to stop at on account of the water and pasturage. The name Rodeo comes probably from the habit of arranging the loads and pack-saddles in a circle, when the train stops for the night or siesta; every load being covered by its proper saddle and other horse-gear.

About nine leagues out we crossed the Rio de Mendoza, running to the north-northeastward. It is divided here into three streams, about half a mile apart; but a league off on either hand they unite. The first stream is about three yards wide; the second, ten; and the third, four. Each of them is a foot or eighteen inches deep, and has a very sluggish current. In dry weather nearly all the water of the Mendoza is consumed in irrigating the land; but in rainy weather a considerable stream finds its way into the lakes of Guanacache, to the southeastward of San Juan. These lakes also receive the waters of the river San Juan, and, I believe, of one or two other small streams. Fine fish are said to abound in them; one kind, called the *trucha de Guanacache*, being much vaunted for its excellence. The flats between the three streams, into which the Mendoza is divided at the ford, are covered with a thin white deposit, called salitre. So much of this exists in the earth as to render the river salt before it reaches the lake.

The soil over which we passed is a fine, loose, and rich one, and of a dark-brown color; wanting only water to make it yield abundant crops.

Discovered that one of my pistols had either been stolen or lost; which was rather distressing, considering the number of stories told of danger from the Indians.

The chacra of the Aldaos is one of a scattering settlement called "El Barrial," from its being very muddy in wet weather. Nearly all the farms (chacras) thereabouts are irrigated by means of canals or ditches from the river Tunuyan, which runs to the eastward along the base of a low range of hills about eight leagues to the southward. The water of this stream is quite

muddy, but very readily settles when taken out for drinking purposes; differing in this respect from that of the Mendoza, which requires to be filtered before use.

December 8.—The first part of the day was rainy, and, as we were very comfortable under the motherly care of the Señora Aldao, we were in no haste to depart; but about nine o'clock in the morning it cleared away in part, and we took our leave. On mounting I discovered that my saddle-girths were entirely too large for the mule; but being assured of her perfect gentleness, I concluded to make them answer till we reached our next stopping-place. So, "making myself light," I jumped into the saddle without using the stirrups, and set out in fine spirits; these, however, were not destined to last me all day.

From the Barrial, travelling through almost continuous lines of Lombardy poplars and fields, for about five miles, brought us to another scattering settlement, called "El Retamo;" and six miles farther, through the same class of country, to San Isidro, a counterpart of the Retamo—the existence of a shop where aguardiente and knick-knacks are sold appearing to establish the identity of a place, or rather of a name.

In connection with the rows of poplars which form one of the distinctive features of the country around Santiago and Mendoza, it is worthy of remark that the first were brought to this country about the year 1810; and from this original stock they have been transplanted and propagated to such an extent, that they have become the principal ornaments, and, as this is almost the only wood known, it is one of the most useful productions of middle Chile and Mendoza.

At about twenty miles from San Isidro we arrived at an estate called Santa Rosa, having a good dwelling-house and several ranchos about it, where we stopped for the night. It is two miles north of the Tunuyan, and is watered by a ditch cut from that stream.

For the first few miles the road leads through a partially cultivated country, and afterwards through one open, uncultivated, and thinly wooded with small, thorny trees, called Chañares, the highest of which scarcely exceeds twelve feet. On leaving the cultivated country we passed a small stream running to the southward, which is singular, because all the rest we had seen ran to the northward. This one is the surplus waters from the fields above, which is thus returned to the Tunuyan. I mention this to show the flatness of the country.

About half an hour after leaving San Isidro I checked my mule, and took out a map, for the purpose of examining whether the road corresponded with it or not. The wind set the paper to rattling, which frightened the animal to such an extent that she ran away. For fear of coming into collision with the burden-mules, among which she was running, I turned out of the road, sawing on the bridle, at the same time, to bring her up; but the saddle-girths being too long, the more I pulled the more the saddle went to her neck, and she eventually stumbled over a bush—myself, the mule, and saddle, going down together, head foremost. I had an indistinct recollection of seeing any number of stars and mule's heels playing about me; and on recovering from the stunning effects of the fall, found that I had been kicked lightly on the head and ankle, but severely on the knee. The rest of the day's journey was painful enough, but was performed on a very gentle horse. This was my third misfortune, or mismanagement, for by it I broke the barometer tube into a thousand pieces.

One of the old women about Santa Rosa was kind enough to rub my knee, at night, and bind it up in salt and aguardiente, which reduced the swelling somewhat before morning.

It may be as well to remark, here, that the distances I have or may set down, in crossing from Mendoza, are merely estimated by the time occupied in accomplishing them, allowing, generally, about four miles an hour to the regular walk of the mules; but these distances are considerably exaggerated, partly from over-estimate, but principally from the sinuosities of the road.

December 9.—Set out at 5.30 A. M., and travelled twenty miles to the east-southeastward, through a country cultivated in some parts, but generally thinly wooded with Chañares and Retamos. At the distance of two miles passed the post-house of Santa Rosa; at six miles a rancho; and

at eight arrived at a scattering settlement called Las Catitas, consisting of some half a dozen houses, about which there are a few small, cultivated fields. Turned to the south-southeastward at a bridge across a large acequia, or ditch for irrigating, and continued along, between pastures on the left, and thinly wooded country on the right, to a farm-house on the one hand, and the post-house of La Dormida, off among the woods, on the other; afterwards, five miles through uncultivated country, and around a low hill to a grove of Algarrobas, on the banks of the Tunuyan, where we stopped to get dinner and pass the siesta.

My leg was very much swollen, and so painful that I was obliged to make a cushion on the horse's neck with a blanket, and ride lady-fashion. The weather till noon was rainy, and the road very slippery. Wind from the northward. After noon it cleared up.

The Tunuyan, at our stopping-place, is a third of a mile wide, full of sand-flats, and apparently shallow, with a current of about three miles an hour. A number of ducks and cranes were feeding on its flats, and there are said to be fish of good quality in it.

At 4.30 P. M. set out again, and at 8.30 arrived at a small town called Acorocorto, or La Villa de la Paz. The first six miles of the road is by the river, sometimes over its flats, and at others through tolerably thick groves of Chañares, Algarrobas, and Retamos; the remainder is at a little distance from the stream, and leads through groves of the same wood. At two-thirds of the way passed a couple of huts on the right, occupied by goat-herds; and about three miles before arriving we found the guard in one of a collection of huts. Here we were put under charge of a soldier, who led us on a wild goose chase through mud-holes and bushes to the town, where he left us, after notifying the comandante of our arrival.

Our first impressions of Acorocorto were anything but favorable. It had rained very hard there, and the whole town appeared to be one great mud-pool. The only lodging-place we could find was at a wretched pulperia; where, besides the grog-shop, there was but one room, which was lumbered with casks of aguardiente, sacks of grease, horse-gear, and a variety of other articles. Into this we were all tumbled with baggage and saddles, and passed the night, of course very indifferently, the only redeeming point in its experience being a good supper. Mr. Blanchard had shot several partridges and plovers along the road, and having found a dry spot in the yard on which to make a fire, he turned to—Frenchman-like—and prepared for us a most savory mess.

In addition to the discomfort of our quarters, we had other reasons to be doleful. In the efforts to conquer an unbroken mule, one of our best peons, by some inexplicable means, managed to run a knife through his foot; and on entering the yard of the pulperia, Aldao got a severe wound just above the knee-cap, from the roasting-spit, which had been foolishly left sticking out from one of the loads; so that we now counted three cripples in three days' travel.

December 10.—A fine day rendered our prospect less gloomy; and Acorocorto, instead of being a mud-puddle, really turned out to be a town—if the existence of one principal street and one or two cross-streets, sufficiently built on to make their limits and direction known, are enough to constitute one. It has a large plaza, bounded on one side by the government house, embracing the barracks and prison, and on the opposite side by two or three dwellings; the two remaining sides being partially marked out by mud-walls. The houses are of one story, built of enormous adobes (about four feet long by two feet thick*), are without windows, and have nearly flat parapeted roofs. Only one or two in the town are whitewashed.

I suppose the population of the place and its environs to be about five hundred, including some twenty-five or thirty soldiers, kept here by the province of Mendoza—of which this is the most easterly settlement—to prevent incursions of the Indians.

There is but little cultivated land about it, and that is principally planted in alfalfa. It is irrigated by water from the Tunuyan, which passes about two miles south of the town.

* These large adobes are made on the spot they are intended to occupy; and when the first course is sufficiently hardened to bear the weight, another course is moulded on top of it, and so on.

While at work in the plaza, an enormous herd of oxen was driven in from the eastward; and I had barely time, with the aid of the peon, to pick up my instruments and hobble off before they swept, like a living sea, over the very spot we had occupied. From Acorocorto the cordilla is fully in sight, and as the lower portion is below the horizon, it presents the fine view of a barrier, apparently entirely covered with snow: Tupungato, with its hemispherical summit, towering above all.

At 5.15 P. M., having finished work—for which my companions had waited—we again set out, and at 8.30 stopped for the night on the side of a little hollow; where, however, there was no water to be found.

Road generally through low bushes—principally jarilla and algarroba; mocking-birds abundant, as they have been since leaving the mountains. Found this day, as heretofore, that where there had been a deposit of water, there was a thin coating of salitre.

The distances, as usual, are all gum-elastic; and places said to be four leagues off, may turn out to be two or eight.

Our arrieros and peons were as amusing and light-hearted a set of fellows as I ever met, and two or three of them had some pretensions to poetry. As we rode along, in the cool of the morning or evening, they would enliven the time by improvising some long-drawn-out song, generally referring to their personal adventures, but occasionally conveying a hint that a present or treat from their "patrones" would be acceptable.

Their ordinary style was for one to commence with a lusty interjection of "*Ay, que me ha dicho;*" and after chanting all he might have to say, end with some strongly accented word. Another would then take up the song, make some response to the subject of his companion's verse, and finish by rhyming his last word. This in Spanish, where the past participles sound so nearly alike, is very easy; and I have known these fellows go on, alternating in this way, for one or two hours together; not making very good music, certainly, but displaying considerable wit and humor.

December 11.—Twenty miles from last night's stopping-place brought us to the Desaguadero, a stream which discharges the surplus waters of the "Lagunas de Guanacache." Where we crossed, it was about four yards wide and eight inches deep, with a current to the southward, of three miles an hour. It is salt and bitter, except after heavy rains. A few miles to the southward it unites with a part of the Tunuyan, with which, after spreading out in marshes, it turns to the northward and enters a salt lake, called El Bebedero, where it is either absorbed or evaporated.

Two or three leagues to the westward of the Desaguadero, a place is marked on the map we had "Las Tortugas:" there is no sign of a habitation on that part of the road, and we should have passed without thinking of it, if we had not discovered a terrapin. I suppose the name comes from the fact that tortugas (turtle) are found there. It is not at all uncommon to find instances of the kind; there are very many places on the maps with imposing names, where there is not even a hut.

The road from Acorocorto to the Desaguadero is over what is called a travesia, or place where no water can usually be found; but when we crossed it there was a great deal in many parts of the road, from the heavy rains of the two previous days. Country wooded with Chañares, Retamos, and Algarrobas. Passed on the road a swarm of large grasshoppers—locusts—apparently at war with strange-looking black flies. These were about the size and shape of wasps, and had a red spot on their tails. Their hostility to the locusts appeared to be wholly wanton, for I could not observe that they did more than kill them. We had before seen myriads of small locusts, generally feeding on the leaves of young algarrobas, but had not seen any large ones except these.

After crossing the Desaguadero, which is the dividing line between the provinces of Mendoza and San Luis, we proceeded two miles farther, and stopped for dinner at what is called a represa—a flat or hollow place, dammed around, so as to contain the rain-water. As the

represas are not protected by any shade, the water is warm and disagreeable; but still, it is better than that of mud-puddles, from which both cattle and men are frequently obliged to quench their thirst.

From here the cordillera is still in sight, and a view of it bothered me a good deal. At Acorocorto I took a general look at the whole chain, and saw nothing higher than Tupungato; but just before arriving at the Desaguadero, I turned to look, and discovered that there was another peak to the northward, much higher. At first I supposed it to be a cloud; but as it did not change appearance, I concluded it was Aconcagua, and determined to take angles on it, but on dismounting, found myself too much knocked up with my lame knee; and before I was sufficiently recovered, the cordillera was enveloped in clouds, so that I was left in doubt as to whether I had really seen Aconcagua or not.

At 4 P. M. we set out, and at 6.30 camped at the Represa de las Cabras. There is one hut at this place. Country as usual. Liebres and large partridges abundant. Grasshoppers in myriads.

December 12.—Started at 2 o'clock A. M., and after travelling twelve miles, passed the Represa de Chomes, where there are two wretched huts. From this the lake called the Bebedero is in sight, about nine miles to the southward. It appears to be nearly circular, and is perhaps ten miles in diameter. Thence twelve miles further, brought us to the post-house and represa called "El Balde." Country up to this point less thinly wooded.

This post-house is built of adobes, is square and high like a block-house, and surrounded by a stout palisade made of trunks of trees. There are three or four ranchos about it, in one of which dwells the owner of the land bordering the Bebedero. Being referred to him as the person best acquainted with the country and streams thereabout, I made him a visit, and, after answering the usual questions as to whether I was a *medico*, or had any *remedios*, succeeded in obtaining the following information: That the Desaguadero, and a part of the Tunuyan, enter together a small laguna called the "Corral de Tortoras," which is sometimes nearly dry; and that from this pond or marsh, a stream flows to the northward, and empties into the lake called the Bebedero, or drinker, from which there is no outlet. To account for what becomes of the water that enters it, the popular belief was, that there was a whirlpool (resumidero) in its centre, through which it is discharged into the earth. That part of the Tunuyan which does not unite with the Desaguadero turns to the southward, and after receiving the waters of the Atuel and Diamante, finally ends in a salt lake far to the south.

From El Balde we proceeded six miles farther, and stopped at a represa. Our road lay through a country with very little undergrowth, but with larger trees than any we had seen, some of the algarrobas being sixteen inches in diameter, and thirty feet high. Weather warm and clear, the thermometer in the shade being 93°, and in the sun 101°—not as comfortable as it might be for a ride of nine hours.

This represa, which is now abandoned, consists of a collection of about a dozen huts, formerly occupied by soldiers, stationed there to protect the country from the Indians, and has on its most elevated ground the trunk of a large tree, with a scaffolding on top, where a look-out used to be kept. The represa itself—that is, the pond of water—had been neglected so long, it had dwindled to a mere puddle, some twelve yards long by three yards wide, and six inches deep. The water was perfectly green, and had to be strained through a handkerchief before it was fit to drink.

Saw a large iguana and a number of liebres in the course of the morning's ride.

Twenty miles from the represa brought us to San Luis, where Aldao and myself arrived at sunset, having pushed on at a gallop, leaving the rest of the party behind. The country through which we passed is more cheerful, the approach to the town being marked, of course, by the presence of occasional farms and houses. About half way there is another represa, with a few huts in its neighborhood.

Feeling the effects of the impure water we had drank at the place where we passed the siesta, we made it a point on our arrival to call for and drink three several tumblers of water each,

and by that time we were in a fit state to contemplate calmly the nose of the keeper of the hotel, which was of such wonderful dimensions and form as to require one to be perfectly cool before approaching it. I have never seen anything, in all my experience, either in nature or caricature, equal to it. From the eyes it branched off, and became wider and longer till it completely hid the mouth and a great part of the chin. Its color was of a deep purple; and as the owner of this tremendous appendage was so palsied that his nose never would keep still, it will readily be believed that it was an object of deep interest to me.

Our companions arrived at the Fonda about nine o'clock at night, and, being anxious for their comfort, I hastened out to welcome them with a large glass of good cool water. Unfortunately a misstep in the court-yard dislocated anew my knee-cap, which was just recovering from the effects of the kick. This determined me to do what I had frequently thought of before, viz: to take an arriero and mules for myself, and travel alone, as I had already found that, however willing my companions were to stop whilst I did my work, it was annoying to feel that I was detaining them, and very fatiguing for me to mount and keep along with them after eight or nine hours' work. Accordingly, on the second day after our arrival, I managed to get to the door and see them off, feeling much more friendly towards them at the moment of separating than I had done during the trip.

Before separating, however, I succeeded in getting permission for Mr. Blanchard to take a portrait of Don Manuel. This, of course, was rather a delicate matter. As I was to remain behind, it was my interest not to offend either the *patrón* or his family; but a desire to give to the world the picture of a nose which is, I have no doubt, the same that Sterne describes in Slawkenbergius's story, overcame my discretion. Approaching Don Manuel, therefore, I said to him, in a most insinuating and deferential tone, I supposed he could not be ignorant of the fact that he had a most remarkable feature in his physiognomy; that I was very far from wishing to offend him, but my friend, Mr. Blanchard, being a celebrated philanthropist, had, through life, endeavored to do everything in his power to relieve persons suffering under painful or inconvenient diseases; and having noticed his nose, was desirous to have a picture of it, for the purpose of submitting it to a distinguished surgical friend in France, in order to learn the nature of and a remedy for the disease. I added, that as Mr. Blanchard had a delicacy in asking, I had volunteered to request him to sit for his portrait. The old Don was overcome by my eloquence, and readily consented; and in a few minutes we had a perfect fac-simile (barring the palsy movement, which could not be put on paper) of the greatest nose that ever existed.

"San Luis de la Punta," so called from its being situated at the point of a range of mountains, is a miserably decayed place, and, to judge from its appearance, must be rapidly decreasing in population. It is the capital of the province of San Luis, which probably contains fifteen thousand souls—the town itself and its environs having about three thousand. It has, of course—no Spanish town is without it—its plaza, one side of which is bounded by a barrack and a church, both in good repair; on another side by a second barrack and a few one-story adobe houses in bad repair; and on the other two, by huts and walls in ruins. The streets are at right angles with each other, and in some places have narrow sidewalks, and paved gutters in the middle. As the houses are nearly all built of adobe, and very little attention is paid to whitewashing or repairs, at least one-third of them appear to be in ruins from the effect of the heavy rains of summer. The house of the Governor was the only one I saw built of brick, or in thorough repair. Many have window-frames, but I saw no glazed windows.

There were quartered in the town about fifty soldiers of the line, whose pay was ten reals (one dollar and a quarter) per month, and one suit of clothes a year. Their term of service depends upon the wishes of the government, as they do not enlist for a fixed period, but are draughted. Notwithstanding the smallness of their pay, they were comparatively well dressed, and appeared to have an easy time of it. Their uniform was picturesque, and not unlike the Greek dress. It consists of a flat cap, (which, if blown out, would resemble a sugar-loaf,) common with nearly all Spanish or Spanish-American soldiers; a close-fitting jacket, the chiripá,

and calzoncillas. The chiripá is generally made of a poncho, or blanket, one end of which is tucked under a waist-belt behind, and the other brought down between the legs and tucked in over the belt before, in such manner that the whole waist is encompassed by the two ends—the middle hanging loosely as low as the knees. Calzoncillas are very wide, loose drawers, embroidered and fringed at the foot, but not gathered round the ankles—the amount of embroidery generally depending on the social position of the individual, or upon the state of feelings of his female friends or relations, whose principal occupation beyond household cares is to prepare them. For boots or shoes, the soldier, as well as the ordinary gaucho of the country, uses the skin from the legs of horses or mules. This is cut around near the knee-joint and stripped off. The hoof is then removed, and the skin tanned and rubbed until it is pliable. The part from which the hoof is taken is sometimes closed, but generally is only gathered in, leaving room for two of the toes to stick out—an arrangement very necessary for the use of the stirrups of the country, which are so small as not to admit more than the point of the foot; and not unfrequently a simple knot in the stirrup-leather serves as a substitute by being grasped between the first and second toes.

The health of San Luis appeared to be good, and, from all I could learn, no epidemic had ever raged there. The secret of this probably consists in the fact that they have no medical men whatever, and therefore never yield to imaginary diseases, thus producing real ones. On the other hand, they of course suffer actual diseases, without knowing what they are or how to cure them.

I had some medicines with me, which had been brought along to patch myself with from time to time, and having no further use for them, was about to throw them away, when a visitor in the hotel begged them of me. He only knew that they were "remedios," and it was little matter to him for what diseases they were efficacious. As they were great specifics, I had no hesitation in giving them away, and have no doubt they have effected wonderful cures before this time.

Perhaps I speak too broadly when I say that there were no medical men in San Luis. There are certainly "curanderos" and "curanderas"—curers, male and female, who are competent, and do treat simple cases.

There is only one church in the town, which is under the charge of a curate, who is, doubtless, a very lazy and greedy fellow, for, on the Sunday I passed in the place, there was only one mass, and that at too early an hour for me or any one else to attend who had no obligation to prepare for it by fasting.

But little attention is paid to religion, and less to dress—if the two may be included in the same category.

The hotel, or "fonda," is, in some respects, better than that of Mendoza. There, at least, one gets what he asks for, provided his desires are moderate, whilst, in the latter named place there is nothing to be had out of the usual routine of beef, squash, and chicken. It is possible, however, that I have made a wrong estimate of the comparative merits of the two, from a curious mistake of the cook in that of San Luis. Nothing I could say would convince her that I was not a certain Don Guillermo—an American circus-rider, who had passed through with a troupe some two or three years before. From some of the attempted attentions of this damsel, I formed a very poor opinion of the taste of Don Guillermo.

The only instance of goitre I saw or heard of, was in the case of this very cook, and she had brought it with her from Mendoza.

Wheat, Indian corn, figs, grapes, and other fruits, are here cultivated for home consumption, and could be profitably grown for a market, if there were one at hand. In the vicinity of the town, and to the westward, there are not sufficient means of irrigating, and they depend in a great measure on rains, which I was told were abundant in summer, but of rare occurrence in winter. The farms to the eastward and southward are irrigated by the waters of a small stream coming from the mountains.

Cochineal is gathered in small quantities in the neighborhood, and sold, I think, very cheap, as an old woman brought a cake of it, about the size of my hand, into the shop of a Chilean, while I was present, and sold it for twelve and a half cents' worth of goods. It is, however, only collected by the lazy peasants, when they have necessity for a little yerba (tea of Paraguay) or tobacco.

About fifty miles to the northward of the town, and in the range of hills at whose point it is situated, are the gold mines of "La Carolina," which were formerly worked very successfully, but are now nearly abandoned—there being no one about them except a few natives, who live in wretched hovels, and collect only gold enough by washing to cover their actual expenses.

CHAPTER IV.

FROM SAN LUIS TO ROSARIO.

LEAVE SAN LUIS.—NATURE OF THE COUNTRY.—OUR PARTY.—RIO QUINTO.—SAN JOSE DEL MORRO.—FORTIFICATIONS.—CHURCH WITHOUT A PRIEST.—POPULATION.—A NEW YORKER.—WILD HORSES.—BISCACHAS.—INDOLENCE OF THE ARRIERO STRIKINGLY ILLUSTRATED.—ACHIRAS.—VILLA DE LA CONCEPCION.—APPEARANCE.—POPULATION.—DON MARTIN QUEÑON.—STATISTICAL TABLE.—MY LANDLORD.—AN ADVENTURE.—ADVENTURES OF A DUTCH CHEESE.—INDIANS.—CHRISTIAN CAPTIVES AMONG THEM.—DIFFICULTY OF OBTAINING INFORMATION.—PRESENTS FROM THEM RATHER EXPENSIVE.—AGRICULTURAL PRODUCTIONS.—HAIL-STORMS.—BISCACHAS.—LOCUSTS.—CHRISTMAS DAY.—LEAVE THE VILLA DE LA CONCEPCION.—RIO CUARTO.—UN-ENCLOSED CORN FIELDS.—HUTS OF HERDSMEN.—LA REDUCCION.—SICKNESS OF ONE OF THE MULES.—NOVEL CURE.—VIPERS.—OSTRICH NEST.—MOSQUITOS.—GLUTTONY OF THE ARRIERO.—DIFFICULTY OF OBTAINING FOOD.—PEJE TREE STATION.—ALMOST PERFECT HORIZON.—SALADILLO DE RUI DIAZ.—FORTIFICATIONS OF THE CAREZA DEL TIGRE POST-HOUSE.—RIO TERCERO.—DESMOCHADOS.—SUPERSTITION OF THE PEOPLE.—ARRIVE AT ROSARIO.

December 20.—Left San Luis at 6 A. M., and at 3 P. M. arrived at the Rio Quinto—distance estimated thirty-six miles, as follows: Five around the point of the San Luis range, through a wooded country, with occasionally huts on either hand; five to two streamlets flowing to the southwestward, whose waters are consumed in irrigating the neighboring fields; and thence, at a very short distance, the road emerges from the wooded country, and for twenty-three miles leads across the pampa or prairie land, where there are no trees or shrubs, except chañares and algarrobas, at long intervals—the surface being gently rolling, and covered with wire-grass about a foot high. Three miles before arriving at the Rio Quinto, there are occasional clumps of algarrobas, and ridges of low, rocky hills—some of the rocks appearing to be marble, and are of dazzling whiteness.

Our party consisted of the arriero, his peon, and myself, with only one wretched old horse for a change in case any of the animals in use should fail. As for the arriero and his man, they were very different from my former companions. The first was very taciturn, and travelled along, with his enormous ill-looking face dropped on his breast, looking as surly as a bull, and the only words I could ever get out of him were, "What did you say, sir?" "Yes, sir," or "No, sir;" or, if I asked where we would stop, he would answer, "in such a place," "con permiso de Dios y Maria santisima"—never failing to add this devout clause of "with the permission of God and the most holy Mary." The peon was a fool, and appeared to have no other idea than fear of the arriero; so that I was lonesome enough.

We stopped for rest, and to eat our dinner on the bank of the river; and after remaining there nearly three hours, set out again, and travelled till nine o'clock, when we camped by the road-side. The weather during the day was nearly clear, and the sun very oppressive. Wind light from the southeastward.

The Rio Quinto, or fifth river, rises near the Carolina mines, in the mountains north of San Luis; and where we crossed it was about twenty-five yards wide and two feet deep, with a current of five miles an hour to the south-eastward. Six or eight leagues to the southward it reaches the more level land of the pampa: has scarcely any current: spreads out into lagunas and marshes, and is lost. There are several ranchos on and near its banks at the ford, with some few small corn fields. The people appear to live in great wretchedness, but are very polite and obliging. After crossing the river the road leads over rocky hills, thinly wooded with algarrobas and chañares for about six miles, when it again enters on the open pampa.

December 21.—Started at daylight, and at 11.30 A. M. arrived at the little town of San José del Morro. Weather clear. Wind strong from the northward. At the distance of twelve miles from the river we passed a hut, and two miles farther on, a second—there being between the two a marshy hollow, overgrown with long grass, called "cortaderas," from the edges of the blades being serrated. Hence this pair of wretched huts, two miles apart, is dignified by the name of "Las Cortaderas." At eighteen miles passed a dry river-bed, which, after leaving the cortaderas, is the only break in the plain. About fifteen miles to the northward of this there is an isolated range of hills, some ten miles long, lying south-southwest and north-northeast. On arriving within three miles of San José the pampa ceases, and the road leads over rocky hills to the town.

San José del Morro is at the southern point of a range of tolerably high hills, which does not appear to be more than sixteen miles long, and tapers to the southward of the town till it blends with the plain. Its appellation of "del Morro" comes from a high and solitary hill jutting into the pampa from the range to the southward, which, from its form, is called "El Morro." It is a compact place, walled and ditched on two sides to protect it against the Indians, the other two sides being partially protected by a small stream of good water; but the absence of trees of any kind gives it rather a desolate appearance. It covers about four squares of ground, one of which is the plaza. This has a neat little church on one side, that, singular to say, is without a priest, and depends upon the curacy of San Luis; so that, when there is necessity for clerical aid, the inhabitants have to send twenty-four leagues. On my second journey I took a letter from a distressed woman to the curate of San Luis, requesting that he would come down to perform a marriage ceremony. Besides the houses in the town proper, there are a number of huts scattered about, on the banks of the streamlet. The population is estimated at one thousand, including in this number some two hundred soldiers, who are quartered there, and in the small forts more advanced towards the Indian frontier.

The best house in the town is that of a "New Yorker," named Van Sice, who, after establishing several printing-presses in various parts of South America, and pursuing fortune in other honorable ways, finally married an intelligent and very comely native, and settled down in San José. His assortment of merchandise was the best I had seen on the eastern side of the cordillera, and he appeared to be doing a thriving business.

Notwithstanding the little attention paid to religion in that part of the country, and the great advantage it was for any woman there to obtain a husband so industrious, intelligent, and "well to do in the world," Mr. Van Sice was obliged to turn Catholic, and confess himself —or, as he said, tell a pack of lies—before he could be married. I passed the siesta at his house, and was very hospitably entertained.

Nearly all the horses I had seen on the road had very thin tails, and were so different from the droves of wild horses I had been led to anticipate, from reading narratives of travellers, that I inquired about the matter, and learned that there are no wild horses on the pampa, or, at least, none which had not owners; and, as regards their tails, I was told they were plucked once a year, the hair being about the most valuable part of them. With the exception of one or two droves we passed on the day of our arrival at San Sosé, all that I had seen since leaving Chile were very ordinary looking animals. Of horses proper, however, but few were seen, as the droves we had passed, grazing on the pampa, were composed almost entirely of brood-mares, with their respective stallions. The horses are broken as soon as they are old enough, and are either sold to drovers or used for travel, so that they are seldom seen grazing in herds. Mares are very rarely ridden, and are only of value for breeding, or for their hair and tallow, large quantities of which are exported from Buenos Ayres.

We saw a great number of biscachas on the road, but they only appeared early in the morning or late in the evening, when it was too dark to examine them. During the day they keep in their burrows, at the mouths of which little owls are generally perched, apparently on duty as sentinels. I suppose that, as they can only see at night, they are kept awake by the darkness

of their holes, and therefore during sun light take a nap. After leaving the wooded land near San Luis we saw no more large partridges or liebres.

As it was not certain that Mr. Van Sice would ask me to dinner, I gave the arriero money to buy beef, with directions to let me know when it was roasted, in order that, if I failed in obtaining somebody else's dinner, I should have my own to fall back on. In due time, however, I partook of a good meal served in the house, and, supposing the men would look out for themselves, turned in for a nap. When it was nearly time to start again, I went out, and found the arriero asleep under an ox-cart, but without beef. He said he had not been able to find any, and that neither himself nor the peon had eaten since the previous day—a matter which appeared to give him no uneasiness at all. In answer to my inquiry as to what we were to do for dinner the next day, he very coolly said he supposed we should have to "suffer." At the expense of a good growl on his part for the want of endurance of "los estrangeros," I succeeded in persuading him to exert himself, and we procured enough charqui for our necessities. He was perfectly willing to fast for sixty hours, rather than trouble himself; and as the peon was away taking care of the horses, he had no vote in the matter.

At 6.30 P. M. we left San José, and at 9.30 P. M. camped. The first part of our road was over rocky hills, and the last over rolling ground. Passed two or three streamlets running to the southward.

December 22.—At 5 A. M. left camp, and after travelling twenty-four miles, by estimation, or thirty-six from San José, we stopped in a small valley watered by a streamlet whose banks are shaded by a little grove of willows. This is the dividing line between the provinces of San Luis and Cordova, and was one of the most delightful places we had found in which to pass the siesta—the water and shade being both equally cool and refreshing. At the distance of ten miles from our last night's stopping-place, we passed a low rocky hill lying north and south, and at twenty miles crossed a streamlet running to the southeastward, near which there are one or two ranchos with small patches of cultivated ground around them. The road leads over pampa except at the streamlet, where there are low rocky hills. Wind strong from the northward. After the siesta set out again, and at the distance of five miles we arrived at the village of Achiras: road, as before, leading over rocky lomas thinly covered with soil, in many places entirely bare. Achiras, like San José, is partly surrounded by walls and ditches, which, with two little streams, constitute its defences. It is built more scatteringly than the latter, and covers a greater space, but I think does not contain more than half the population. It has a plaza and chapel, but there is a decayed look about the place very different from the fresh appearance of San José. Perhaps the style of building and general aspect of the two places may be better understood by comparing San José to a pile of new-made adobes, and Achiras to a cluster of old ones, rain-washed. The latter, however, has the advantage of being partially surrounded by trees. On the banks of the streamlets by which it is watered, there is a fine grove of fig-trees, which very much relieve the otherwise decayed appearance of the collection of ruinous, thatched mud-huts.

While the arriero was procuring food for the following day I rode into the town to obtain cigarritos, and was amused at the astonishment and contempt expressed by an old gentleman, to whom I referred for information as to where they could be bought, when he learned that I did not know how to make them. After lecturing me severely upon the folly of travelling in the pampa without carrying my own tobacco and paper, he insisted on my dismounting to take a lesson in the art of cigar-making; and when I had acquired knowledge of the *modus operandi*, he made me a present of a few, and started me off, not, however, before I had obtained, through the agency of a soldier, a good supply ready made.

As soon as the arriero was ready—he having procured a sucking calf for food—we continued our journey and travelled till ten o'clock, when we camped on the pampa. After crossing the streamlets near the town, the road leads for about four miles over rocky hills, similar to those we had passed near some of the other streamlets, with the exception that the prominent rocks here,

instead of lying horizontally, are inclined to the westward at an angle of about thirty degrees from the horizon, the strata cropping out above the road. At the distance of five miles there is a grove of willows, and near it is the Rio de la Laja, a small stream, about fifteen feet wide and two deep, running to the southwestward. On reaching the level country, this stream, like most of the others, is lost in the lagunas and marshes.

After crossing the river, our road led over pampa, and, at the distance of twelve miles from Achiras, we passed a rancho or two called Los Barranquitos. Met a drove of some five hundred cattle bound to Chile.

December 23.—Rain and hail throughout the night, and no shelter. Mosquitos excessively annoying.

Fourteen miles over pampa brought us to a streamlet of brackish water called Arroyo de la Lagunilla, flowing to the southeastward; and thence about nineteen miles over the same kind of country to the "Villa del Rio Cuarto," or more properly the "Villa de la Concepcion." We had passed two huts, one at twenty and the other at thirty miles from our camp of last night—the country is diversified by occasional shallow ponds and marshes, around which numbers of deer and guanaco were seen grazing.

The Villa de la Concepcion is situated near the west bank of the Rio Cuarto or Fourth River, and, like other towns on the Indian frontier, is fortified by ditch and wall. These fortifications would be of but little avail against soldiers, but are quite sufficient against Indians, whose only arms are the lance and the "bolas," and who always attack on horseback.

The town is laid off in squares—has its plaza, with a barrack and church on it, as usual, and in almost every respect is like others I have described; the outskirts consisting of sorry mud-huts, and the centre but little better, except that its houses are whitewashed and of a more regular construction, the best of them having brick floors instead of the bare earth. It has not so large a population as San Luis, but is a much more thriving-looking place. About five hundred soldiers are stationed there, and in several little forts to the southward, to keep a look-out for inroads from the Indians.

The necessary formality of presenting myself to the official dignitary of the place was more profitable to me here than in any other town through which I had passed on the road. It gave me the opportunity to make the acquaintance of Don Martin Queñon—the dignitary in question—from whom I received many polite attentions, and some information respecting the rivers, and which confirmed what I had learned before. Don Martin also gave me the following statistical table, which I have no doubt is perfectly correct:

Table of the Population, &c., of the several Towns and Villages of the Department of the Rio Cuarto, in the Province of Cordova, furnished by Don Martin Queñon, Jefe Politico del Departamento.

	Churches.	Houses.	Heads of families.	Children.	Domestics.	Horned cattle.	Brood-mares.	Sheep.	Indian corn, bushels.	Principal invested in commerce.
Villa de la Concepcion . .	1	217	1,222	1,300	499	3,500	37,000	38,000	74	$12,900
Villa de la Carlota . . .	1	85	230	255	92	1,339	1,637	5,966	21	850
Fuerte de la Reduccion . .	1	32	84	107	42	227	279	1,814	6	
Fuerte de las Achiras . .	1	75	178	297	92	287	734	2,374	14	1,000
Fuerte del Rodeo Viejo . .		45	114	128	94	438	890	3,865	14	

I was amused at this gentleman's quiet way of getting rid of my landlord—an officious fellow, who pestered me no little during my stay here. I requested Don Pancho—the landlord—to show me the way to the government house, and as he was glad of an opportunity to intrude

himself among his superiors, he insisted upon going with me. All the women in the house were called in requisition to fit him out, and half an hour afterwards the illustrious Don made his appearance "dressed to kill" in a blue broadcloth jacket and pants, and a red gold-laced waistcoat; the suit, he told me, in which he had been married, and which he never wore except on special occasions. Thus equipped, he set out to accompany me, evidently expecting to be treated according to his cloth; the eyes of an admiring mother, wife, and child—to say nothing of the cook—following us till we were out of sight. Greatly to his disappointment and mortification, he was received in a manner decidedly contemptuous. As soon as he had made known the object of my visit, Don Martin invited me into the parlor, and turning to Pancho, dismissed him with a "Very well, my man; the gentleman now knows the house, and you can go." Poor Pancho retired, crest-fallen, and on my return I found him in his dirty every-day suit, very much overcome with liquor.

One of my fellow lodgers at the posada—in which there was only one room for travellers, serving as bed-room, dining-room, and parlor—was an old Bolivian, who used to bore me a geat deal by talking about the dangers of travelling, which he illustrated by narratives of personal adventures. One evening a person dressed as an officer called, and informed me a lady who was a half country-woman of mine—her father having been an Englishman—had seen me the day of my arrival, and learning that I had difficulty in obtaining lodgings, was about inviting me to her house, when told that I had found accommodations, but she had deputed him to say that she should be happy to see me. As it was dull enough at the posada, I accepted the invitation, and while dressing for the visit, noticed that the Bolivian was very uneasy. He made several signs to me, and finally, during a momentary absence of the officer, told me I ought not to go alone with that person, because he had a notoriously bad character, and would entice me to some out of the way place and rob me. Finding that I paid no attention to his warnings, he requested my arriero to follow to prevent foul play; but I soon put a stop to that, by sending the arriero to give some directions about the horses, and finally sallied out in company with my military friend, whose features, I must confess, were not very prepossessing.

Although I had despised the warnings of the Bolivian, a nervous feeling came over me when I found myself alone with my companion. This made me regret I had not brought a pistol, and induced me to open a sharp penknife, which was held in readiness for use. Armed with this, I proceeded three or four squares along dark and solitary streets, keeping close to my companion, watching every movement with the vigilance of a cat, and expecting him to turn on me at every dark place we passed. I had become so nervous with the idea, that I am certain if he had stumbled against me by accident, or had made the least movement of a hand towards his knife, I should have stabbed him on the spot, without waiting to learn his intentions. The open door of one of the best houses in the place, the cordial welcome of a well-dressed and fine-looking lady and her family, and the dignified reception of an elderly Don Marido, into whose house my companion ushered me, drove away apprehensions, and gave place to a feeling of shame and mortification for my cowardice.

We passed an agreeable evening, heard some excellent singing from the lady of the house, who accompanied herself on the guitar, and returned to the posada sworn friends. After this, I stopped the Bolivian's grog—which he had been drinking at my expense—and found, from his altered manner towards me, that this was the only link of sympathy between us.

You will perceive there was wanting only a knave to make this an adventure. The fool was already supplied in my proper self.

One of the few amusing incidents that happened on the journey was at this place. Among the articles of small-stores remaining of those laid in at Santiago, was the shell of a Dutch cheese. On the road this had attracted the attention of my arriero, who greatly wondered at a shape and color so different from the cheeses of the country; and on our arrival, he had informed the keeper of the posada that I possessed this great curiosity. It soon became

the lion of the hotel, and after being tasted and examined by every one there, was about to be returned to its place in the provision chest, in a very dilapidated condition, when we were honored by the presence of two handsome and well-dressed young ladies, who called ostensibly to visit the wife of Don Pancho, but really, either to see a tall and handsome young Mendoçino, a fellow lodger, or my bar magnets, (which had acquired some fame), or both. Their curiosity with regard to the cheese was as great as that of the people of the hotel, and it was a matter of regret to me that I could not offer them, in addition to the few crumbs scooped from its bottom, any other delicacy than "Eau sucre," slightly dashed with aguardiente. The last affected their tongues to such extent that they bored us, for near an hour, with a conversation which was entirely local, and therefore uninteresting. At length they took leave, to our great satisfaction, when I again restored the unfortunate cheese to its place, and prepared to retire for the siesta. The cheese was worse than a nightmare. I had hardly made myself comfortable before a servant came in with a note from the mother of the young ladies, stating that she regretted exceedingly her health would not permit her to call on me, and requesting that I would send her some of the cheese to try. I suppose I ought to have sent her the whole; but it was really too valuable a "stand-by," and so I sent only a few crumbs.

There were some thirty odd Indians in the Villa del Rio Cuarto, who had come in to traffic, and were guests of the government while they remained.

Their appearance does not differ from that of our North American Indians; and, like them, they are addicted to the vice of drinking to excess. They had only for sale ponchos, mantas, and bolas. Of these they were disposing little by little, according to their desires for aguardiente or toys. Among them were several Cristianos, as they are called—natives of some of the provinces, who had been carried off when young, and reared among the Indians, till they preferred that mode of life to any other. One of these was rather an interesting woman. She was still young, and had evidently been very fair and handsome; but was now so burned by the sun, and had so far acquired an Indian expression of features, as to attract but little sympathy by her looks. She came to the posada to beg bread, and remained some time in conversation with the women; who, seeing that she still preserved a little silver cross hung around her neck, that she appeared to regard with childish delight, endeavored to persuade her to leave the Indians and return to Christian life. She played with her cross, wept a little, but said it was too late then; that she had a husband and children among the Indians, and could not leave them. While she was talking, a fine-looking young Indian passed on horseback, sawing on an accordeon, and so drunk he could hardly keep his seat; and, on discovering the woman with us, he addressed a few guttural sounds to her in a very surly tone, and rode on. She now became urgent for the bread; stating that she had been placed under his charge by her husband, and that he had ordered her to the camp. What she asked for was given, and she went away at a trot, apparently a good deal alarmed.

Hoping to obtain information from a party who came to the posada, I ordered a large glass of aguardiente, and commenced questioning the cacique through a young Cristiano, who acted as interpreter; but could get no answer to inquiries respecting the Tunuyan and some other streams, except that they were "*Alla, muy tierra adentro*"—a long way in the interior. As regards the nature of the country in which they live, he said it was not pampa, but thickly wooded. He also told me that I could go down among them in perfect safety, as they were a peaceable people, and never interfered with those who did not trouble them. I have no doubt that, personally, I should have been safe; but it is more than probable I would have been robbed of everything. Indeed, several of the natives along the road told me that a foreigner was much less exposed to danger from the Indians than themselves; and there is good reason for this, for it is known (or at least is generally stated) that one of the former governors of the department of the Rio Cuarto treacherously induced twenty-five or thirty Indians to come in for the purpose of making a treaty, and then had caused them all to be assassinated.

While we were talking, the liquor was brought out and handed to the chief, who took a sip

and passed it round, first to me, and then from one to another, until it was finished. They declined to drink more, on the ground that they had been very drunk the night previous.

This cacique made the interpreter take off his poncho and present it to Don Pancho; who, I was surprised to see, bitterly regretted the necessity of accepting it. On inquiry, I learned that, in consequence of that present, the whole party would consider themselves entitled to the hospitality of the house; and, in all probability, would drink enough liquor to pay for the poncho three or four times over.

Their style of dress did not differ much from that of the gauchos; and nearly everything they had for sale was carried on their persons. Although they come on their trading expeditions well equipped with ponchos, &c., they manage to leave with a very limited wardrobe.

In the vicinity of the town Indian corn is cultivated in small quantities; and also figs, grapes, peaches, plums, apricots, &c. Of the latter, the figs were just ripening at the time we passed, although we had had them ripe in Mendoza.

At the time of our arrival in la Villa de la Concepcion the tops of the trees were entirely bare of leaves and twigs, from the effects of a heavy hail-storm, which had passed over a few days before. The frequency of these storms in summer is one of the three principal bars to agriculture on the pampa. The first are locusts, which are very destructive; the second the biscachas; and the third, as I have said, the hail-storms.

Christmas day would have passed away without our knowledge, but for the serenade of a military band composed entirely of negroes. They were all drunk, and made such an infernal noise, that we paid them pretty roundly to stop their music; indeed, they threatened to play until we did pay them. It is their custom, like that of our negroes in some parts of the south, to go round on this occasion, and either play or dance in front of a house until they receive a present.

December 26.—At 5 o'clock A. M. left the town; and after coasting the west bank of Rio Cuarto for four miles, forded it at a part where it was about fifty yards wide and two feet deep, with sand-flats and marshes in it. Thence our road lay over pampa, and along the north bank of the river. At noon we stopped for the siesta under the shade of a small algarroba.

We passed two or three ranchos, and a small field of corn without a fence or wall, a man on horseback serving for this purpose. This is common on the pampa, where wood is so scarce as to render it impossible, in many places, to obtain a sufficient quantity for fencing.

Although the river was near the road, it was only distinguishable by a dark line on the pampa, and by the tops of a few willows and reeds appearing above its banks. Half a mile from where we stopped there was a hut, which the arriero insisted was uninhabited, and therefore refused to go further; but it afterwards proved to be occupied; and as there was easy access to the river at that point, we might have got plenty of water, and had a bath. As it was, we passed the siesta very uncomfortably, annoyed by flies and mosquitos; and, through the stupidity of the arriero, we were obliged to send the mules back, about three miles, for water, as the river bank near us was a high cliff.

The hut of which I have spoken is similar to nearly all on the pampa occupied by herdsmen, the principal part of it being like a wagon-top in form, and well thatched to keep out rain; while the front is merely a flat, thatched awning, for protection from the sun. In the interior of this one the clothes and other perishable articles belonging to the occupants were stowed, and outside them were two or three stools, a small table, and a very few pieces of wooden-ware, as substitutes for crockery. Both inside and outside there were a number of dogs. These huts, however, are distinct in their construction from the adobe ranchos, which are the head-quarters of the estancia or estate.

The arriero left his spare horse here, which had become so jaded and galled as to be useless.

At 4 P. M. set out again, and travelled till 10, when we stopped for the night. At a distance of about twenty-five miles from the Villa del Rio Cuarto we passed the small village of "La Reduccion," and from there turned off from the river and followed a path leading more directly

than either of the two main roads. From the "Villa" there are three roads. The principal, or post-road, turns to the northeastward, and after reaching the Rio Tercero, joins that from Cordova, and follows the bank of the latter river to Saladillo. The next road coasts the Rio Cuarto to its junction with the Tercero, at Saladillo; and the one we took diverges from this last at La Reduccion, and strikes directly across the country. Of the three, the safest is by the Tercero; and next that by the Cuarto, or by the Punta del Sauce, as it is called; these two being defended against Indians by post-houses and forts, or stockades; while the last is over a desert country. La Reduccion is fortified, as usual, by a ditch and wall; its population is given in the statistical table of the department; and as we did not stop there, I know nothing more respecting it.

The place where we stopped for the night is near a stream called there Las Chilcas; but farther to the northward, Chucul. At the ford it has very little current, and half a mile to the southward spreads out into marshes and ponds, which are quite salt, and swarming with wild fowl. Lions and tigers are also found there. These, and, indeed, everything undomesticated, from a mosquito to a lion, are called, by the country people, by the name of "*bichos*"—a word meaning, literally, vermin, and corresponding, in its corruption, to our southwestern signification of the term "varmint."

Before our arrival at camp we missed the track and got into the edge of this marsh, and were soon so completely bewildered that we did not know how to get out: fortunately, the arriero discovered, through the darkness of the night, a distant hut, and, leaving us to await his return, rode off to procure a guide. The denizens of the pampa, like sailors, have, by long practice, acquired the habit of discerning and "making out" distant objects that are invisible to the unpracticed eye. Those of them with whom I have been would frequently call attention to some distant speck and confidently assert whether it was a deer, an ostrich, a horse, or an ox; just as the sailor knows land in the faint pencil-mark above the horizon, which to the eye of a landsman has no meaning.

December 27.—Travelled about sixteen miles over pampa, with occasional lagunas on each side, and stopped for the siesta near one of these, where, except an occasional clump of low bushes called chilcas, there was no sign of a tree or shelter from the sun. We were delayed on our journey, first by losing the road, and next by the sickness of one of the mules. As it may appear singular we should lose our path on the open pampa, I will state that we followed a track which had been used in dry weather, and it led us into a marsh, around which we were obliged to make a long detour. The illness of the mule was supposed to arise from a retention of urine, from which animals on the pampa frequently suffer, in consequence of the bad water they drink. In order to induce him to make an effort to relieve himself, the arriero and his man commenced emitting wind violently from their mouths, thus making a disagreeable though not uncommon noise, which at times appeared to be on the point of producing the desired effect; but after a while a more desperate remedy was resorted to: the mule was ridden at full speed two miles up the road and back, under which operation he fell several times, and then followed a repetition of the former remedy. In the mean time, we were at a halt on the pampa where there was neither shelter, water, nor prospect of getting an animal to supply the place of the sick one nearer than La Reduccion. The efforts to effect a cure, therefore, were highly interesting to me, and I readily lent my aid as far as wind went. At length, after repeated gallops and volleys, the poor animal did really relieve his bladder, and at once got well; whereupon, the arriero threw his head back and piously—but rather indelicately, considering the character of the Virgin—exclaimed, "Gracias á Dios y Maria Santisima, ya meó." He told me he had made a vow to the Virgin that he would perform some kind of penance if she would relieve the mule; and had done the same for me on our departure from San Luis, when he found I was almost too lame to travel, and seemed very much shocked when I doubted that the vow had anything to do with the cure of either myself or the mule.

At our stopping-place I made a bed with my horse gear, in a position that would at least

afford shelter for my head; but when I was about to occupy it, the peon discovered a vibora coiled away between the holsters, which put all further ideas of rest out of the question.

The vibora is a small snake, from eighteen inches to two feet long, very much resembling in appearance what in North Carolina is called the ground rattlesnake. Its bite is said to be a deadly poison. We passed the siesta in wandering about looking for ostrich nests, of which we found one filled with eggs and young birds. Some of the eggs were quite fresh, and served the men for dinner; but I found them hard and unpalatable, and preferred to make my meal of charqui.

We saw large numbers of deer, guanacos, and water-fowl feeding about the laguna, and *felt* enough mosquitos to last me till doomsday.

Weather clear. Wind from N.E. Thermometer 92° in the shade, and 95° in the sun.

At 3.45 P. M. set out again, and travelled till 9, when we camped. Passed two ranchos, dignified by being called Lucacha. Road as before—over pampa, with occasional lagunas, in which a great number of ducks, cranes, and plover were feeding.

December 28.—Passed a miserable night. With his usual want of foresight, the arriero stopped in a bight nearly surrounded by marshy ground and lagunas, where we were so pestered by mosquitos that at one o'clock—finding it impossible to sleep—I ordered a march; but, unfortunately, two of our mules had strayed off, and we had to endure the discomfort of the flies and a drenching shower of rain till half-past six.

Travelled till noon, and stopped near a rancho called Los Torsales.

On the way the peon killed a partridge with singular dexterity by riding around it until the bird was confused, and then knocking it over with his knife. At our stopping place it was roasted and offered me, I conceived, as a compliment; but, as we had started on the principle of all sharing alike, I divided it into three parts, and we partook equally. After a while, feeling hungry, I inquired for dinner, and learned that my two worthies, to whom I had been so generous with the partridge, had eaten up all there was, supposing that the bird would suffice me. I have before spoken of the habits of these people with regard to fasting, and I mention this circumstance as proof of a directly opposite quality. When we left the Villa de la Concepcion we had enough beef and charqui to last any three reasonable appetites a week, but these fellows had eaten it all in two days.

They can fast a long time, but are also capable of devouring more meat than grizzly bears. Fortunately, the owner of the rancho was kind enough to sell us some new cheese, on which we made a comfortable dinner.

The traveller on the pampa must not take it for granted that he can procure food at the different houses along the road. On the contrary, he would be more able to sell than to buy the necessaries of life. It is a remarkable fact, that although essentially a cattle-growing country, it is very difficult to obtain beef. One may purchase a whole ox or a sheep; but to buy a few pounds is almost impossible: the country people kill and dry only the amount they require for their own use, and have none for sale. At one place where we stopped, on my second journey, the people refused to furnish us at any price, denying that they had anything, until the arriero discovered a pile of charqui, which I suppose was prepared from some animal that had died a natural death, as it was so inferior that it was destined for the use of the dogs; and even this they were very reluctant to sell. As for bread, except in the towns, it is wholly out of the question: the natives generally beg bread of travellers.

At 4 P. M. set out again, and travelled till 8.30 P. M., the road leading over pampa, with occasional lagunas. We saw several swans and flamingoes in some of these. Wind strong from S.E. Weather clear and warm. Thermometer at 3 P. M. 84°.5. Mosquitos pestiferous!

December 29.—Left camp at daylight, and at 9 stopped for work under the shade of a fine peje tree. Nothing could have been more fortunate than the discovery of this tree. I had been informed farther back that in Saladillo there was no appropriate place for magnetic observations, and had been on the look out for a shady tree under which I might make my experiments free from the

interruption of curious people, which, by the way, was always an important consideration, for the gauchos universally wear spurs and sheath-knives, and it was difficult to make them understand that these affected the magnets. Sometimes they would come close to where I was at work, with hidden knives, merely for the purpose of seeing whether I could detect their presence by the action of the magnet. Near some of the lagunas, we had passed occasional trees that would have answered but for the annoyance of mosquitos. At length this one presented itself, at some distance to the right of the road, and, allowing the mules to go on, I galloped off, and found it the most appropriate place I had seen since leaving Chile. To hurry on and stop the party was my next step; and as fortunately there was a pond of tolerable water near, we had all we could desire. This peje tree, with three or four algarroba companions, stands on a little knoll; and what was particularly delightful about it was, that although the mosquitos were swarming at the distance of fifty yards in every direction from it, there were only a few under it.

Here, in its delightful shade, I was able to conclude work before sunset, and be off again in time to avoid an attack from flies, which, with the falling shades of evening, were losing all respect for the tree, and came swarming around us. We had the satisfaction, however, before finally leaving, to see them slaughtered right and left, by hundreds of mosquito-hawks (dragon-flies) that appeared to have sprung into existence by miracle, as we had before only seen an occasional straggler.

The tree was about two feet in diameter, forty feet high, and had fifty feet spread. Its limbs were closely interlaced, and filled with nests, principally of the scissor-bird, common to the country from Mendoza to Rosario. This is about the size and color of the mocking-bird, and gets its name from two long tail-feathers, resembling the blades of a pair of scissors.

As this was one of the most level parts of the pampa we had passed, I had the curiosity to set up the theodolite, and see how far it departed from a perfect plane. Setting the horizontal wire on the horizon in one direction, I turned the instrument through the circle, and found five minutes' depression at every point except north, where, by the intervention of a knoll, it was only two minutes and thirty seconds, and at northeast four minutes; so that an observation with the natural horizon, in the most unfavorable direction, when corrected for dip, would have been only two minutes and a half in error.

It may seem ridiculous to attach so much importance to a single tree, but it really is not so. The traveller on the pampa frequently looks in vain for one under whose shade to pass the siesta, and with whose wood to cook his beef. He may discern one, apparently a long way off, that offers, as he thinks, every requisite; but, on nearing it, he finds that what looked stately in the distance is a mere shrub. These disappointments are of continual occurrence. One of the places where we passed the siesta had so very little shade to recommend it, that I urged the arriero to go farther; but he refused, telling me I ought to give "gracias á Dios" for even that much; and after we were farther advanced over the pampa, I found he was right.

Travelled about sixteen miles farther on the 29th, and stopped near the little village of Saladillo. During the night there was a very heavy dew; weather clear, and, for the season, cold. Thermometer at 4.30 A. M. (December 30) 56° Fahrenheit.

December 30.—Set out at daylight, and at 5 o'clock entered the town of "Saladillo de Rui Diaz." It is partially surrounded by walls and ditches, and consists of some two hundred thatched adobe houses and huts, not one of which is decent in appearance. It has a plaza and barrack, where there were about eighty soldiers quartered, but has no church, and, with greater advantages than any other town along the road, is perhaps the most wretched looking. The three roads from the westward, and that from Cordova, all pass here, and, to judge from what we saw, there must be a great deal of traffic and travel at this point. The country was alive with trains of ox-carts and mules, going or coming. There were in sight about a hundred carts, and altogether it was a very enlivening scene, reminding us, in an unmistakable manner, that we were approaching civilization; for which, to use the arriero's expression, I gave "gracias á Dios y Mariá Santisima." The creaking wheels of the ox-carts, heard far and near, the

bleating of kids and calves, and the lowing of cows, although not very agreeable music in themselves, were highly refreshing after our solitary journey.

They were killing an ox for the use of the soldiers, but we were unable to buy any beef, and had to fall back on miserable charqui.

Saladillo is situated near the junction of the rivers Tercero and Cuarto, the latter of which was very much smaller there than at the place where we formerly crossed it. Near the Punta del Sauce it spreads out, forming lagunas and marshes, and a great part of the water is either evaporated or absorbed in the soil. That which reaches the Tercero is impregnated with salt to such an extent as to be useless for irrigation or drinking. The Tercero is a more considerable stream. It empties into the Paraná, and only in very dry seasons is too salt for use.

Crossed the Rio Cuarto where it was fifteen yards wide, two feet deep, and had a current of about two miles an hour, and thence proceeded along near the south bank of the Tercero, over pampa, as far as the post-house of "Cabeza del Tigre," where we stopped for the siesta. Half way we passed a post-house called the "Esquina de Lovaton."

"La Cabeza del Tigre" is better fortified than most of the post-houses we had passed. It is surrounded by two walls and an intermediate cactus hedge, with another cactus hedge and a ditch outside of all. Besides the post-house, there are one or two huts outside of the fortifications. Weather very oppressive. Thermometer 93° in the coolest place about the post.

This day, for the first time, I was obliged to use authority with the arriero. He fancied that his animals were suffering in their hoofs from the heat of the ground, and wished to stop for the siesta on a part of the road where there was neither shelter nor fire-wood with which to cook our dinner; and although the post-house was in sight, about a league and a half farther on, I was only enabled to force him to proceed to it by threatening not to pay him the stipulated price on arrival in Rosario. The secret of the matter was, that my man was as avaricious as he could be, and invariably preferred camping away from settlements, for fear of having something to pay.

Left the post-house about 4 P. M., and travelled till 8 o'clock, when we camped three miles to the eastward of the post called "La Cruz Alta." Country pampa, with occasional marshes. Wind E.S.E. Weather clear. Mosquitos awful.

December 31.—Five miles farther brought us to the post called the "Guardia de la Esquina," which is not so well fortified as many others. It is surrounded by quite a collection of huts, in one of which I saw a young man and his sister who had been captives among the Indians, but had succeeded in effecting their escape. They had been about a year among the "Christians," and the woman had married, but the man was pining to return to savage life. He sold me his best poncho, and with the money proposed to purchase a horse to carry him back to the Indian country. Saw also a remarkably pretty and bright-eyed girl—not a very common sight on the pampa.

The Rio Tercero here was near fifty yards wide, apparently deep, and had a current of about three miles an hour. The gauchos had lassoed and dragged on its banks a few large logs, indications that the country is better wooded farther up.

Left "La Guardia," passed the post of Arequitas, then a deserted two-story brick house, and stopped for the siesta at one of the ranchos in the vicinity of the post of Los Desmochados. The post-road which follows the river Tercero from beyond Saladillo here leaves it, and turns more to the southward, the river trending to the northward.

On the afternoon of our arrival at the Desmochados a violent thunder-storm arose; and as the rain continued all night, we did not leave our comfortable quarters at the farm. The people did everything they could to make our time agreeable. I had a good meal, a comfortable room, where there was a raw-hide bedstead and no bugs, and, what was more important, some one to talk to, for which I was beginning to feel great necessity in consequence of the taciturnity of my arriero and his man. The people were very devout, and had prayers at night in presence of the whole family. I was in my room when they commenced their devotions,

and, without being aware of what they were about, intruded, but did not disturb them in the least: the old lady offered me a chair, and the service went on as usual. When the thunder-storm commenced, a little bell was brought out, and rung violently at every sharp flash of lightning, with a view of warding off danger. They had implicit faith in its virtues, as it had been specially consecrated for that purpose. This superstition probably comes from Spain. In Moratin's comedy called "El si de las Niñas," Doña Francisca, in examining the presents made her by the nuns whom she had just visited, makes an exclamation of delight on discovering among them a little bell blessed for thunder—"una campanilla de barro bendito para los truénos."

January 1, 1853.—Set out at 5 A. M., and at 3 P. M. arrived at the town of Rosario, situated on the west bank of the Rio Paraná; and here my journey on horseback ended.

The day was rainy, and our road lay over pampa and, in some places, very marshy ground. This is not the post-road, but a short cut through the country—that road turning more to the southward, and passing round the marshy ground. Saw an iguana, about four feet long. Passed several ranchos and immense herds of mares grazing. As we approached the town, we of course found the houses more frequent.

About twelve miles out, the vegetation of the pampa, instead of being wire-grass, as we had had it all along, was principally fennel, thistle, and other weeds. From the accounts of some travellers, one is led to believe that there is at certain seasons a rank growth of thistles all the way across the country. This, I think, is a mistake. Thistles are common near Buenos Ayres and Montevideo, and generally near the river banks; but on other parts of my road I saw no signs of such a growth.

Paid the arriero the sum agreed on for my transportation from San Luis, (sixty-five dollars,) gave him all my blankets and some other riding gear, and dismissed him, rather glad of the riddance. The rascal had so little grace as to offer the blankets for sale before my eyes within two minutes after he had received them. It was very plain that he had no romantic ideas of sympathetic affection. I was obliged to sell my saddle, bridle, and holsters, in order to raise means to pay expenses down the river; for I was reduced to the last extremity in money matters.

CHAPTER V.

ROSARIO, AND A VOYAGE TO THE UNITED STATES AND BACK.

DESCRIPTION OF ROSARIO.—COMMERCE.—DANGERS OF THE ROAD ACROSS THE PAMPA.—VOYAGE DOWN THE RIVER.—VESSEL LOAD OF FRIARS.—BIRD CALLED THE "BIEN TE VEO."—RETURN TO THE UNITED STATES.—OBTAIN PERMISSION TO RETRACE MY STEPS.—SAIL FOR MONTEVIDEO.—AN OVER-RELIGIOUS FELLOW PASSENGER.—ARRIVE IN THE RIO DE LA PLATA.—VOYAGE TO ROSARIO.—HAMPERED WITH A FRENCHMAN.—NEW IMPRESSIONS OF ROSARIO.—DIFFICULTY OF OBTAINING CONVEYANCE TO MENDOZA.

El Rosario is the most modern-looking town on the road. With the exception of huts on the outskirts, the buildings are all of brick and mortar, and for one falling to decay there are ten being built. The plaza has on one side a neat church, and on the others comfortable-looking stores and residences, in front of which there are wide sidewalks—the latter being unusual in Spanish American towns. The streets are not yet paved, but in most places have sidewalks. Along the west bank of the river there are occasional algarrobas, and lower down on the flats there is a grove of willows. The banks are about forty feet high; and in muddy weather it is rather a difficult undertaking to reach the landing-place—there being no improvements in that direction for foot-passengers, and the road very much cut up by ox-carts. While I was there, there were eighteen vessels loading for Buenos Ayres and Montevideo. Nearly all were owned and sailed by Italians, although under the Buenos Ayrean flag.

The opening of navigation of the river, and the blockade of Buenos Ayres, had brought all the trade of the interior to Rosario; and as transportation from there by water is so much easier than by land, it is probable that the town will increase rapidly. There is very little cultivated land about it; and, indeed, after leaving the Villa del Rio Cuarto I saw no more than small garden spots near some of the post-houses.

As it is usual at both ends of the road to talk a great deal about the dangers of crossing the pampa, it may be as well to say something here on the subject.

As the Indians were at peace when I passed over it, I cannot speak from experience with regard to danger from them; but I do not believe it ever has been very great for travellers. Their inroads were generally made at night, and with great secrecy; and their principal object was to drive off mares and horned cattle. If in the pursuit of this they fell in with defenceless drovers or herdsmen, they usually put them to death—partly to prevent news of their presence being carried to the fort, though most generally from a desire to retaliate, or from a naturally cruel disposition; and it is probable that travellers fallen in with under the same circumstances have shared the same fate. But as it was contrary to the interest of the Indians to follow the main road, or of travellers to take any other, these encounters were not of frequent occurrence. At all events, I do not think that, for an Englishman or an American, the danger from Indians ever was or ever will be so great as that to be apprehended from some of the lower class gauchos. We are all known as or are supposed to be heretics, the shedding of whose blood is not considered a very grave sin, and is sometimes even considered a merit. To the commission of this meritorious act let there be added the prospect of pecuniary benefit, and the heretic who finds himself unprepared, and in a lonely place, with no other company than two or three gauchos, stands but little chance for his life. As they are cowardly, so are they treacherous; their usual mode of attack being to approach with a very civil air, requesting fire or a cigar, and at the first unguarded moment of the traveller out comes a knife, and—adios!

Generally, however, there is no necessity to run such risk. By taking a well-known arriero, and being careful not to stray away from him when near suspicious characters, but little danger need be apprehended. From the arriero there is nothing to fear, if proper precaution has been taken to procure one well recommended. They know very well that, if anything happen to their "patrón," they will be required to account for him; but it is quite as necessary to learn who and what the persons recommending one are, as to know the character of the arriero himself. Generally it is better to refer to the chief of police, or juez del barrio. A Chileno in San Luis recommended my man, Luis Alvarez, to me, and I ascertained afterwards that it was only to recover a debt of four dollars due from him. On my second journey across the country, as there was some difficulty in obtaining good horses in the province of San Luis, I inquired for Alvarez, intending to bargain with him to carry me to Mendoza, but was told that I had better put my head in the fire than trust myself with him, for he was the greatest knave in the country. The Chileno was among those who gave me this advice, notwithstanding his former recommendation.

If, in addition to other precautions, the traveller on the pampa will profess himself a Catholic, or "Christian," (as the Catholics are called), or wear a rosary, cross, or scapulary, in such a manner that it may be seen, the danger will be much less; for, as it is unusual to see a "gringo" who is not a heretic, any exception is looked upon with great consideration.

I do not know that I would have been exposed to danger under any circumstances, but am satisfied that the chance was much less in consequence of my having a scapulary—a present from a friend in Chile—worn at first as a memento; but so soon as I found that my arriero, although a great knave, was a devout Catholic, I determined to make another use of it, and allowed myself to be surprised several times attentively regarding it, apparently engaged in my devotions. The desired effect was produced, and I was firmly believed to be a Christian; taking which in an un-catholic sense, I never denied.

What I have said of the arrieros may also be said of the postillions who accompany travellers from one post to another; they are considered perfectly trust-worthy.

On the 5th of January I embarked on board of an uncomfortable little Italian schooner, for Buenos Ayres, where I arrived on the 10th, heartily sick and tired of the mosquitos and of eating tripe and maccaroni—the only food our capt in provided.

On the passage down the river we passed an Italian brig on her way up, which had on board some forty friars bound across the country to Chile.

It often struck me, as we drifted or sailed down the Paraná, that the people thereabouts ought to be very honest. There is a little bird very common on its banks, called, from its notes, "bien te veo." These notes come out so suddenly and clearly, that I thought it would be impossible to be guilty of bad conduct in the presence of the little monitors. Sometimes when taking a pull at the captain's jug of aguardiente, the clear, sharp, and spiteful "que bien te veo"—how well I see you—would break on me from the overhanging trees, and almost induce me to return the jug untouched to its locker.

I arrived in Buenos Ayres without money, and was unable to get a draft cashed; so that I was in a strait. Commodore McKeever relieved me, however, by giving an order on Purser Gulick, of the Jamestown, for the amount of pay due me.

The custom-house officials in Buenos Ayres appeared to take particular delight in throwing as many obstacles in my way as their infamous system admitted. Before attempting to disembark my baggage, I went to the resguardo, and stated that, besides personal equipage, I had a set of instruments, with which I proposed to make a series of observations, and was told that there would be no difficulty in passing them. Acting on this assurance, I landed and got my things into a cart, expecting to have no other trouble than merely opening them on the mole. On the contrary, I was obliged to go to the custom-house for a permit; and from the custom-house it was necessary to go and look for a shop where stamped paper could be bought; then to find some person who would word the permit in due form; and finally to the collectors, to get

it signed. Supposing my troubles over, I repaired to the mole, where, after unpacking in presence of the officers of the resguardo, I found that I should be obliged to carry everything to the custom-house, because, forsooth, some of the instruments looked new. At the custom-house it was necessary to go through the same labor of unpacking again—and all this in the sunshine, with the temperature of the air about 90°, that of my temper at 212°. When the curiosity of the clerks was satisfied, I was told quietly that the instruments could not pass, because they were not comestibles—as if anybody ever supposed that magnetical instruments were comestible. Heartily wishing that the custom-house officers were food for the worms, I repaired to the collector, and, by speaking my mind very freely to him, succeeded in getting an order to have the things passed.

After making a full set of observations in Buenos Ayres and Montevideo, I embarked on board the American barque "Almeida," Captain Kearney, and without special incident arrived at New York, after a passage of fifty-six days.

A short time before my return, Congress had passed a law giving extra pay to officers and men who had served in the Pacific during the Mexican war, and I found myself with sufficient funds to enable me to return to South America and ascertain the longitudes of my stations satisfactorily, as also to complete the chain of barometrical measures across the country. Having obtained permission to do so, at my own expense, I again, on the 12th of August, 1853, sailed from New York for Montevideo, on board of the ship "Margaret Eliza." We had a pleasant passage out, and an agreeable set of passengers, with the exception that they were too religious for me. One of them, who was fresh and red-hot from a camp-meeting at Cape Cod, seemed to think it his special mission on earth to convert me, and gave me no peace until he concluded I was past redemption. He was constantly telling me, with a whining, nasal twang, that he had Christ in his heart; he knew it; he felt it: that he was ready to die at any moment, and that death had no terrors for him. Nevertheless he was very scary about the ship; and all day long, in bad weather, when not praying, would sit in the boat stowed on the poop, and watch both captain and the weather with intense anxiety. If a squall struck the ship, he would turn very pale, shut his teeth hard, and hold on to the boat's gunwale with both hands, looking the picture of terror. On such occasions I could not resist a desire to ask him if he had Christ in his heart then.

I made a set of observations in Montevideo, and another in Buenos Ayres, and then engaged passage in a Buenos Ayrean schooner for Rosario. The captain and crew were, as usual, Italians.

On embarking, I found some seven or eight passengers, among whom there was an overgrown, sentimental-looking Frenchman, who appeared to be a stranger to all on board, and was pensively whiling away time with a flute. His green spectacles, and indeed everything about him, made me suppose he was an author, and it was not until we were near Rosario that I found him to be a cook—a regular Parisian *artiste*—who had been thrown out of occupation by the siege of Buenos Ayres; was "hard up," and bound to Chile in search of employment. All this was told me when he learned that I had been looking for a servant in Buenos Ayres. He was anxious to serve me, and asked no more than that I should pay his expenses; but as I wanted a man accustomed to the country and to the management of horses, I declined the offer, suggesting, however, that he should make a bargain with the arriero whom I might employ, and in that way he could get a mule or two added to my train at a very low price. This he decided to do, and I thus became burdened with an incumbrance that could not be gotten rid of until our arrival in Chile.

Rosario did not make so great impression at my second visit as at the first. The houses did not look so fine, nor did the dresses of foreigners, attired in the European style, appear so elegant. I suppose the reason was, that on the first visit I saw it after crossing the pampa, where nearly all the towns have an aspect of decay, while on the second I was fresh from New York. Nevertheless it is an exceedingly thriving place, and even during my short absence gave evidence of increased prosperity, in the organization of a club of foreign residents, where

the amusements incident to civilized life were afforded to the better class of citizens and visitors; and in the establishment of agencies to some of the large English and German commercial houses, as well as in the increased size of the town itself.

There was greater difficulty in obtaining conveyance to Mendoza than I had anticipated. There are no professional arrieros about Rosario, except those who come down with trains from the interior, and all my efforts to find a trust-worthy man who would transport me, with baggage and instruments, at anything like a reasonable rate, were unavailing. The only chance was to buy animals, and hire the men myself; and this might have been the most economical if I had been accustomed to a country life; but as there was a strong probability of being imposed on by careless or dishonest men, who would either lose or steal the animals, I did not care to run the risk. I next tried for a carriage; but the expense was too heavy. Then the idea of buying an ox-cart and three or four pairs of oxen suggested itself; but this, too, offered so many difficulties in the way of time and money, that it was abandoned. At length, after losing several days in fruitless negotiations, I determined to go by post, for one of my objects was to arrive in Mendoza in time to observe the solar eclipse of the 30th of November.

CHAPTER VI.

FROM ROSARIO TO MENDOZA.

LEAVE ROSARIO BY POST.—POST-HOUSES.—ARMADILLOS.—SALADILLO DE RUI DIAZ.—FRAILE MUERTO.—FAMILY OF THE COMANDANTE.—VILLAGE SCHOOL.—MASTER OF THE POST AT THE ARROYO DE SAN JOSÉ.—VIOLENT THUNDER STORM AND EXTRAORDINARY DISCHARGES OF ELECTRICITY.—VILLA DE LA CONCEPCION.—THE LANDLORD AND HIS COMPANION.—LABORS OF THE VESSEL LOAD OF FRIARS.—SAN JOSÉ.—SAN LUIS.—BOILING-POINT APPARATUS.—COLONEL BAIGORRI.—EL BALDE.—CATCH A TARTAR.—ACOROCORTO.—MY MAN DON MARCOS.—THE FRENCHMAN'S FALLS ACCOUNTED FOR.—ARRIVE IN MENDOZA.—RESUMÉ.—NATURE OF THE COUNTRY.—AGRICULTURE.—RIVERS.—CANALS.—RAILROAD.—ANIMALS.—BIRDS.

After having made arrangements to send all my heavy baggage by a train of ox-carts, and to take with me only what was absolutely necessary, packed in two small trunks, I advised the Frenchman to go by the carts, because it would cost him very little; but, as he expressed great disinclination to travel alone, it was decided that as the two would require but one postillion, he would be relieved of that part of the expense, and therefore should accompany me.

We left Rosario at half-past three P. M. of the 7th of November, and rode at a gallop through a hard rain a distance of about twenty-four miles, to the post-house called El Saladillo de la Orqueta, only stopping to change horses at the post-house "De Luna," as there were then no accommodations for travellers.

Procured a chicken for supper at the Saladillo de la Orqueta, and a hide bedstead to sleep on. Foolishly pulled off my boots on going to bed, and in the morning found my feet so much swollen that I could not get them on: therefore travelled in slippers, which, as one of my ankles is weak, was exceedingly inconvenient.

November 8.—Changed horses at the post of La Candelaria, and stopped at Los Desmochados for dinner, but could obtain none. This post consists of three or four adobe huts; that for travellers having a hide bedstead in it, which was occupied while we were there by a sick gaucho, who stuck to it like a leech, taking care when he had necessity to go out, to have a friend occupy it until he should return, for fear we would take possession. Besides this bed, there was the usual adobe bed-place against the wall; but as we had ridden all the morning in a hard rain, our things were too wet to sleep in, and we therefore determined to push on to the next post-house. The beautiful girl I had seen the trip before at the Guardia de la Esquina was now at the Desmochados, having married a ferocious-looking gaucho.

Pushed on to the post of "Arequitas," where I arrived so completely used up that I could with difficulty sit my horse. The barometer and three chronometers, together with my money and cartridges, after three or four hours' travel, appeared to weigh twice as much as before. Weather still rainy. Found the master of the post very civil and attentive.

November 9.—The first post to La Guardia de la Esquina lies over pampa. Passed a polecat in the road, which was disposed to show fight; but as he had the advantage of weapons, I backed out. Found everything about the post-house exactly as I had left it, except that the man who sold me his poncho had left for the Indian country, and the pretty girl was away.

Second post to "La Cruz Alta." Crossed and recrossed the Rio Tercero at fords which were about twenty-five yards wide and a foot deep. Stream not near so full as on my former journey.

Cruz Alta is a little settlement of some twenty huts, with gardens about them. There, as elsewhere on the road, we were pestered by people desirous to change Cordova money, which

is not current in any of the other provinces. Stopped here for dinner and rest, for the Frenchman was tired out, and had travelled the last post with a firm hold on the crupper and pummel of the saddle.

Third post to La Cabeza del Tigre, where we stopped for the night. Road leads near the south side of the Tercero, which, as its banks are high and bare of trees, is only marked on the pampa by a dark streak. One of the peons about the place having just returned from a hunting expedition, on which, with the aid of dogs, he had captured a dozen armadillos, I ordered one prepared for supper, and found its flesh very savory. The meat is dark, and resembles that of the opossum in flavor. We had a chicken to fall back on in case we did not like the armadillo; but the Frenchman, who for the first and only time volunteered his professional services, spoiled it by too much seasoning. Passed the night here, and experienced very sensibly one of the great inconveniences of travelling fast on horseback before being accustomed to it. All night long in my muscles I felt the gallop of the horse, the weight of the barometer hanging across my shoulder, and the breech of the carbine thumping against my back, exactly as if I had been awake and riding.

November 10.—Our first post was to "Esquina de Lovaton," coasting the river; country pampa. Saw a number of horn-plovers, and birds resembling canaries, though smaller.

Second post to the Saladillo de Rui Diaz, where we stopped for a set of observations. This place did not present the same appearance of business as on the first trip. Here I was bothered, as usual, by people seeking remedies for their diseases.

During the night—which we spent at this post—we had rain, thunder, and lightning, confining us to the house, where our companions were fleas and lice.

November 11.—To the post-house of Las Barrancas. First part of our ride rainy, and last part clear. The master of the post at Saladillo maliciously gave me a horse that would not stand to be mounted, which came very near finishing my trip suddenly. After the rain ceased, I alighted to put my poncho on the crupper, and when about remounting, the horse dashed off before I could get into the saddle; but by good luck and hanging on by his mane, I succeeded in attaining my seat before he had gone far.

The river at the Barrancas was only fifteen yards wide and one foot deep. It had very little current, and was brackish. The post-house consists of three mud-huts, unenclosed.

Second post to the Zanjón. Passed a rancho; country pampa; vegetation, wire-grass; river bank in sight, about a mile from the road. This post-house is worse than the last; it consists of two ranchos, with the wreck of a shed for a kitchen. We could get nothing to eat there but four eggs.

From this post to the village of "Fraile Muerto" country pampa, with occasional hammocks of chañares and algarrobas. Passed several ranchos to the right and left; and also two women on one horse, the oldest and ugliest of whom rode astraddle.

Stopped in Fraile Muerto for the night, and for work on the next day.

The village is built in an irregular and straggling manner, and contains a population of about seven hundred inhabitants. It has some few comparatively good houses, the best being that of the governor. The post-house is a part of his, and is the most comfortable on the road. Here the attentive care of the servants of the governor, who is also master of the post, made our time very pleasant.

This gentleman appeared to use his authority over the people to a very good end. By persuasion or force he had induced them to plant fruit-trees, and build walls to enclose their grounds; had established a school, and forced them to send their children to it; and in other respects had paid such attention to the comfort and appearance of the place as to give it a much more prosperous look than others of its size on the road.

He had an intelligent and agreeable family, whom I could not help pitying for being obliged to live so far removed from the refinements of the society to which they had evidently been accustomed elsewhere.

While there we saw a procession of bare-headed, and in some instances bare-breeched boys, on their way to chapel to hear mass; the schoolmaster following them, armed with a large rod, apparently for the purpose of whipping up the stragglers. They were chanting a hymn in a very monotonous tone.

November 13.—First post to Las Tres Cruces. Road the same. Weather clear. Met at this place a Cordovese merchant, whose galera had broken down on the road. He was very eloquent on the subject of the misfortunes to which travellers are exposed. Next, to the post of "Esquina de Medrano," consisting of two tolerably good houses, and three or four ranchos. Road pretty well wooded with chañares and algarrobas. Saw a number of scissor-birds, and passed the broken galera in the road. Its passengers consisted of two priestlings, on their way to Buenos Ayres to receive holy orders, and two young women under charge of the merchant I had met at Tres Cruces.

The river at Esquina de Medrano was nearly dry, but the water was good. We had found at nearly all the post-houses, before this, very good well-water.

The wife of the keeper of the post at Las Tres Cruces was evidently master, for which I had reason to be thankful; because the nominal master gave me a very vicious horse, which she made him change for one more gentle. The postillion rode that which had been destined for me; and I was satisfied, from his tricks on the road, that I should have had a fall.

Third post to the Arroyo de San José. From the Esquina de Medrano the road follows the course of the river for about three miles, and then separates from the Cordova road, turning to the westward, at a rancheria called the Esquina de Ballesteros, consisting of twenty or thirty houses. Thence to the Arroyo de San José, a small stream of tolerable water, about three yards wide and six inches deep. It rises a short distance to the southward, and runs towards the Tercero, but is absorbed before reaching it. There are a few huts on its banks, and the place is known by the name of the Cabral. The post-house is nearly a league farther on.

About half way we passed a rancho, with one or two small patches of land planted in corn; they were unenclosed, and, as usual in similar cases, a man on horseback supplied the place of a fence.

The post-house consists of an ordinary adobe dwelling, with the travellers' room adjoining, and a few huts near it for the use of peons. In the absence of travellers, their room is generally occupied by dogs. The master of the post, who was a dirty old fellow, refused to let us have our meal separately; but when his own was ready, invited us to join him. It consisted of the usual pampa fare—junks of beef—and was eaten in the customary manner, each one helping himself from the same dish—for there were no plates—and fingers served for forks. One peculiarity of these people is, that they seem to consider it necessary to spread a cloth over the table; and, in nine post-houses out of ten, these are actually so filthy as to spoil any but the most ravenous appetite. For this reason I always preferred to go to the fire and get my dinner, as the peons do, directly from the spit.

Passed the night here; and in consequence of the filth of the inside, we preferred to sleep out-doors.

November 14.—To the "Cañada de Luca." Road over pampa. Passed a rancheria, and, at some distance south of the road, a grove of trees. As they had no burden-horses at the last post-house, my trunks were put on one not broken to packs, and he gave us great trouble on the road.

This post consists of two wretched huts, and has nothing in the world to recommend it except good well-water.

To the Tortoral. Country the same. Passed a rancho on the left and a laguna on the right. The Frenchman was thrown from his horse, but, except a few bruises, suffered no harm. This post-house consists of a good dwelling, a tolerably clean room for passengers, and one or two out-houses, and is much more comfortable than the two preceding. Its name, Tortoral,

comes from a marsh and pond near by, overgrown with a kind of blade-grass called *tortora*. In this pond there were a large number of flamingoes feeding

After a good dinner, proceeded to the next post, called El Guanaco; where, although it was still early, we stopped for the night, on account of the inability of my companion to travel farther. This gave me a good of deal uneasiness. I was apprehensive that from bad riding, some serious accident would happen to him; and knowing him to be almost destitute of means, I should have been very reluctant to abandon him in the road; while, on the other hand, any detention would have defeated the object of my expedition. Up to the last post he had been of some service in helping to arrange the load on the burden-horse, and I had willingly paid his expenses; but as he was no longer of use on account of the fall, and, moreover, as I was afraid of getting a fall myself, from the frequent changes to horses I did not know, I took an extra postillion from El Guanaco, to carry the barometer and aid in adjusting the load. As far as the barometer was concerned, I soon found the postillion so awkward that I preferred to carry it myself.

November 15.—To the post of Tambillos. Country the same, with the exception that near the post-house there is a considerable sand-hill, which is unusual on the pampa. The post consists of two or three houses situated on the banks of a laguna, surrounded by thinly wooded sand-cliffs, and, for the pampa, has a decidedly picturesque appearance. The master of the post had a family of very handsome children, the males of which were occupied in tending horses and cattle, and the females at their accustomed occupation of embroidering calzoncillas. One of the latter was very desirous to buy my vest, as a present for her father.

After a long delay in procuring horses, we set out for the post of Chucul, where we arrived about four o'clock, but found no person whatever at the place. Road over pampa, but very much cut up by rains.

Chucul consists of one hut, and is situated on the east bank of a stream of good water, running to the southeastward; the same stream was passed on my first trip, near a place where it spreads out in marshes, and is called there Las Chilcas, but here is designated by the name of the post.

My companion, whose habit was to ride carelessly when not fatigued, swinging arms and body to the tune of some French opera, and who wore green glasses, in order to see nature under the most favorable auspices, neglected to guide his horse, and allowed him to tread into a biscacha hole. The consequence was that the pair of them got a fall, though fortunately there was no harm done.

We were in a great strait at Chucul, for we could get no other postillion than a boy so small as to be unable to arrange the load, but, by good luck, an arriero happened to pass, who did us this favor, else we should have been obliged to do it ourselves. Not that either of us objected to the work, but it requires more skill than we were possessed of to arrange a pack-saddle, and lash on its load in such manner that it will not turn.

Between Chucul and the Villa del Rio Cuarto we were caught in a violent storm, that lasted about two hours, during which the wind blew from every direction, commencing at southwest, and going around by south through all the points of the compass. The lightning surpassed anything I have ever seen—discharges taking place from the earth towards the clouds, and from the clouds towards the earth, not far apart, and almost simultaneously; some of those going upwards were remarkably like rockets, exploding after reaching the clouds, and sending off numbers of smaller flashes in different directions. Then, again, there were flashes like balls of opaque light, or the turning a dark lantern across the eyes, shining dimly for a moment, and then disappearing. The rain and hail, in the mean time, were very violent; the latter inflicting such severe blows, that we were obliged to turn our backs to the wind, and wait for it to shift, before we could proceed on our journey.

I am aware that it is not orthodox to say that the clouds and earth were discharging electricity at the same time; nor do I state this. I only assert what the evidence of my senses

assured me was perfectly true—namely, that at or near the same moment and place, discharges of electricity occurred vertically upward and perpendicularly downward. During the storm occasional puffs of warm air passed by, indicating that it was a local phenomenon, and confined to a small space, which after experience proved to be the fact; for we found that at the time we felt the storm, it rained but little in the Villa del Rio Cuarto, and a short distance to the westward it did not rain at all. As soon as the wind was sufficiently fair for us we pursued our journey, and arrived at the villa about ten o'clock at night.

On going down the steep cliff to the bed of the Rio Cuarto we came near having a mishap, the rain having rendered the road so slippery that it was very difficult to descend. The postillion, who was ahead leading the baggage-horse, got down very well; but the Frenchman, who followed next, had not descended half way when his horse slipped, and for a while the pair of them floundered in the mud at a terrible rate; but at length the horse lodged in a gutter, with his heels in the air, from which we had some trouble to extricate him, and the Frenchman escaped with no other damage than being muddy from head to foot. We found very little water in the river—not a tenth of what there was at the same place I crossed before.

Stopped at the old posada, and found Don Pancho still drunk. In addition to his impertinence, I had to suffer that of a drunken companion, who claimed to be the son of some foreigner, and seemed to think this fact gave him exclusive right to be civil to me. As soon as I asked if we could have something to eat, he bolted out of the house, and in a few minutes returned with a disgusting mess of scraps of beef—the remains of his own dinner. On my refusing to partake of it he became outrageous; and, eventually, it was necessary to point a cocked pistol at him in order to get rid of him.

November 16.—Weather partially cloudy. Made a set of observations.

November 17.—Detained by rainy weather.

From what I heard in this place, the troop of friars passed on the Paraná, last journey, must have sweated under their load here. Their provincial, or leader, preached two sermons a day for the nine days they remained, and all the friars—thirty-five, I think—had authority to receive confession and give absolution. This they did in the church, every day, except Thursdays and Sundays, when they sallied forth to visit the houses and receive confessions of the sick, the lame, and the lazy. When they left town, all the women, and half of the men, accompanied them on the road, and government furnished them with an escort of fifty soldiers as far as the province of Mendoza.

November 18.—The weather was still rainy; but as we had already lost one day, I determined to set out. Before doing so, however, in order to have no further trouble with the load, I made a contract with a man to accompany us and attend to its arrangement.

Left town at 8 o'clock, and rode till night, when we stopped in Achiras. Changed horses at the post-houses of "Los Ojos de Agua" and Las Barranquitas. Weather chilly. Wind southwest, with a heavy Scotch mist. As the road from the Villa del Rio Cuarto is the same passed over on my first trip, it is unnecessary to say anything about the country.

November 19.—To San José del Morro, where we were delayed for the remainder of the day, because the villain of a post-master would not have his horses brought up. It turned out that he had a letter to write to San Luis; and notwithstanding he had all the afternoon before him, he put off writing till the next morning, again delaying us more than two hours. Between Achiras and San José we changed horses at the post of Portezuelo, which consists of two or three huts, situated at the eastern base of a range of rocky hills running to the northward.

November 20.—To the post-house of Rio Quinto, where we dined. The heat of the sun was so oppressive as to produce, at times, a film over my eyes and a singing in the ears. Found much less water in the river than on the former occasion. After dinner, set out on such wretchedly lean horses, that, from the heat and length of the post, (twelve leagues), we could not afford to push them until after nightfall, and even then we could not get more than a draggling trot out of them; we therefore did not arrive at San Luis till after midnight. We found the city illu-

minated—that is to say, there was a light over the door of each of the four principal houses in the main street—in celebration of the election of electors for the presidency of the confederation. The people were all up, and nearly all in the hotel were either drunk or gambling, or both. I met there a Chilean acquaintance, bound to Buenos Ayres to embark for England, who gave me very bad accounts of the condition of the post-horses farther on—as little encouraging to me as my information on the same subject was to him.

November 17.—Made a set of observations here, and, as had been done at Rosario and the Villa del Rio Cuarto, tried the boiling-point apparatus. In Rosario it indicated the same atmospheric pressure as the barometer, but in the Villa del Rio Cuarto, and at this place, very much lower temperature.

I had been desirous, from the time of my departure from Rosario until my arrival in San Luis, to fall in with a Colonel Baigorri—a great man among the Indians—from whom I wished to obtain a safe conduct, in case opportunity should offer for me to penetrate into the Indian country to the southward; but before my arrival he had gone off among them. His nephew, however, was there, engaged in the very characteristic occupation of trying to stab a man with whom he had quarrelled over the gambling table, and to accomplish which he made several unsuccessful efforts during the day.

Colonel Baigorri is a Putano, or a native of San Luis de la Punta, who committed murder, and, to escape the penalty, took refuge among the Indians, where he was kept for a while in close captivity, but was allowed, subsequently, to accompany plundering parties, and on these occasions committed more atrocities than the Indians themselves, after which he was granted full liberty. He soon became a man of great consideration among them, and was their plenipotentiary in all treaties or transactions with the different towns or provinces on the frontier. After the fall of Rosas—the late Dictator of the confederation—General Urquiza succeeded, through Baigorri, in making a treaty with the Indians on a firmer basis than any they had had before; and up to the time I left the country, its conditions—paying a tribute in mares on one side, and abstaining from predatory incursions on the other—had been strictly observed, and the beneficial effects were apparent in the greater confidence with which people along the frontier devoted themselves to raising cattle. Besides this, Urquiza had made Baigorri a colonel, and his nephew a captain in the army, and, to create greater confidence between the two races, had adopted the rather dangerous plan of placing one of the frontier forts under charge of the former, who, I was told, would man it with Indians.

November 22.—Posted, on wretched horses, to El Balde. Found the post-house in charge of a woman, who was the most shrewish vixen I had ever met. At first, she was all amiability; but when I had satisfied her curiosity respecting the instruments, and commenced to hurry her for the horses, stating that I was an officer on duty for the confederation, she inveighed violently against the government for requiring her to keep horses; against travellers in a hurry; and particularly against the drought, which had lasted so long that her animals were as lean as skeletons.

I had heard, before leaving San Luis, that at the Desaguadero, the next post to the Balde, the horses were worse than at any other point, and therefore asked the woman to inquire if any of her neighbors had animals with which they would take me directly to Acorocorto, promising to pay double post-fare the whole way. After getting dinner, for which we paid roundly, and waiting patiently two or three hours, I inquired the result of her efforts, and was informed that an old man, whom I had seen about the house ever since our arrival, would take us for double post as far as the Desaguadero, but that he would go no farther. It vexed me so much to find that we had lost three hours by the humbugging of the woman—who knew as well as I did that she was obliged to furnish horses to the Desaguadero for single post charge—that I lost all patience, and told her if she did not immediately give me horses I would send my servant to San Luis, and see what the government could do for her; and, moreover, if she did not stir herself, I would have her saddled and ridden to the devil. It was worth anything to see

how the old termagant hopped around at that. As for listening to what she said, it would not have been advisable. I certainly did not, but rested satisfied with the fact that the desired effect had been produced, for we soon had the horses forthcoming. While settling my accounts, I noticed a malicious twinkle in her eyes, and we had not gone far before we found that she had, to use a common expression, "taken her change." A set of more worthless animals I never saw. By nightfall we were only a third of the way, and two of the horses were so dead beat that neither whipping nor spurring would induce them to go farther, and we were obliged to stop in the woods, where there was neither water nor food. The next morning (November 23) we started early, and after travelling at a snail's pace, got about five leagues farther, when we were obliged to halt again and let the horses rest; so that it was near eleven o'clock before we reached the post-house of the Desaguadero.

After obtaining something to eat for ourselves, my attention was attracted to the woebegone looks of our postillion, and another, a boy about fourteen years old, who had arrived with a courier two or three hours before. We had passed this little fellow two leagues out, sleeping in the sun while his horses grazed, and he had turned back with us. On inquiring, I learned, that although neither of them had eaten for twenty-four hours, and had to return immediately with their horses, which would probably occupy nearly twenty-four hours more, they could get nothing to eat, because they had no money. Of course, I ordered as much as would satisfy their hunger, which, by the way, was no little, and after giving them a real or so, saw them off, highly contented.

The post-house of the Desaguadero is nearly four miles south of the ford by which we crossed it on the former trip. It consists of two or three miserable ranchos. The travellers' room, at the time we passed, was occupied by two litters of puppies and several chickens.

As it was very warm, the thermometer being 97° in the sun, and the wet-bulb 72°, we allowed the heat of the day to pass before we continued our journey. At midnight, arrived at Acorocorto, after a long, dusty, and tiresome ride. Found but little accommodation at the post-house, and less desire to accommodate; the master of the post being the nabob of the place, and consequently too important a personage to attend to the wants of travellers, but not too great, to receive their money.

Before arriving at this place, my man "Don Marcos" informed me that at one time he had been better off in the world, and as we were now approaching a part of the country where he was well known, it would be very mortifying for him to have his friends suppose he was travelling as a servant. He therefore requested I would say that he was merely accompanying us. I told him I did not care how he represented himself, provided he performed his work. But when we arrived he walked into the post-house, told the master of the post—who was an acquaintance, by the way—that he had been taken sick at the Rio Cuarto, and was returning home in our company; then seated himself very comfortably, leaving me to unsaddle my horse and make my own bed. Next morning I told him he must either do his duty, which was very little, or quit, and thus brought him to his senses. After all his pretension to belonging to the "first family," the fellow was very desirous, on our arrival in Mendoza, that I should employ him as my servant in crossing the mountains, and came several times to effect that object, telling me, on each occasion, about the tabletas (cake made of alternate layers of sweetmeats and pastry) that his wife was making, as a present for me. As soon as he learned I had engaged another servant, he borrowed a dollar of me, and I did not see him again until I was leaving Mendoza the last time, when, at about a mile out, whom should we meet but Don Marcos, riding with a party of friends. He did not see me until I was close up, and hailed him, to know where my dollar and his wife's tabletas were. I never saw such a crest-fallen devil in my life as he was, on being thus accosted.

On the afternoon of the 22d of November, a smart shock of an earthquake was felt from Mendoza to Acorocorto.

November 24.—The forenoon was clear and very warm, the dry-bulb thermometer standing

at 94°, and the wet at 70° in the coolest place. Finished work, and set out with a storm brewing. In a short time the rain commenced, and continued to fall violently until night.

Stopped for the night at La Dormida, formerly a post-house, but not so now; the post being from Acorocorto to Santa Rosa, a distance of twenty leagues. Slept in wet clothes under a shed, the house being full of people, some of whom were ill.

November 25.—Found that the lazy scoundrel of a postillion had left the horses tied to posts all night, instead of allowing them to graze, so that we were obliged to go more slowly than we wished. Got dinner at Santa Rosa—a very comfortable post-house—and afterwards proceeded to the post-house of Retamo through a drenching rain, and until night overtook us, at a very rapid pace. After dark we were obliged to go slowly. There were ditches on both sides of, and frequently across the road, and as the night was very dark—the obscurity rendered more intense by flashes of lightning—it was necessary to proceed with caution. We all arrived at the Retamo in sweet humor: four or five leagues out, the postillion told us that we were one league off, and for three hours it was the same story of "cosa de una legua;" then to increase our discomfort, we found that we could get nothing dry to sleep on, and had to pass another night in wet clothes. Fortunately, we were able to obtain a bottle of aguardiente from a pulperia about a mile from the post-house, and each of us taking a large dose, we managed to get through the night tolerably well.

Shortly after leaving Santa Rosa, the Frenchman's horse slipped, and he got another fall. Being in a position to witness this, his frequent falls were fully accounted for. Instead of endeavoring to recover his horse, he let himself drop off like a bag of sand.

November 26.—Set out at daylight, and arrived at Mendoza about 10 A. M.; having stopped on the way to salute the Aldaos at El Barrial, where I met with a very cordial reception from the Señora, who thought, as did many others, that I had only been as far as Buenos Ayres, and could hardly believe I had passed four months in the United States.

Having finished my narrative as far as it is connected with the pampa, I will endeavor to give a general idea of the country in as condensed a form as possible; premising, that as I know nothing of geology, mineralogy, botany, or, indeed, of any of the "ologies," I cannot speak technically on these subjects.

From Mendoza to a few leagues beyond San Luis, the country is thinly wooded with algarrobas, chañares, retamos, and—where there is an undergrowth—jarillas. The portion between San Luis and the river Paraná is pampa or prairie land, interrupted only by low rocky ridges near the Rio Quinto, San José, and Achiras, which extend some three miles on each side of the river and streamlets watering those two small towns. All of these ranges taper off to the southward, and at the distance of a few leagues from the road appear to blend with the plain. The vegetation of the pampa, with the exception of occasional clumps or isolated trees, is principally wire-grass, interspersed with thin pasturage and small wild flowers. Around the lagunas—of which, owing to the flatness of the country, there are many in rainy weather—there is frequently a rank growth of marsh grass; and in the province of Buenos Ayres, farther south than my road lay, a rank growth of thistles is said to alternate with the other vegetation. The soil appears to be alluvial, and, wherever it can be irrigated, yields abundantly; but there are two great drawbacks to successful cultivation in that part of the country through which I passed, namely, locusts and hail-storms. The former frequently sweep off whole crops; and on the pampa the latter are probably quite as destructive, but are not so frequent or violent in the wooded country. Another difficulty they complain of on the pampa, is the want of wood for fencing; but they could make mud-walls if they chose; and near Mendoza, where there is wood, they prefer walls on account of their durability and cheapness.

In the parts of the country where there are no means of irrigating, and the people are obliged to depend on rains, we passed small patches of corn a foot above the ground; and perhaps a hundred miles farther on, found that they were still waiting for a shower before planting.

The biscacha, also, is said to be very destructive to the crops; and persons who have unenclosed gardens make it a point during heavy rains to dam the water up, and, by means of a ditch, turn it into the burrows, thus drowning them or driving the animals out, when they are killed as they attempt to escape.

Of the rivers passed on the road, the first is the Mendoza,* which rises near the Uspallata Pass, and reaches the plain about sixteen miles south of Mendoza. It then runs northeastward, gradually turning more to the northward until, at the distance of twenty-five miles from the city, it flows nearly due north to the Lagunas de Guanacache, a very small portion reaching those lakes in dry weather, and that portion is salt. The Lagunas de Guanacache also receive the waters of the San Juan from the northward, and I believe of one or two small streams from the westward; and their surplus waters, after speading out into marshes in some places, form a stream called the "Desaguadero" flowing to the southward.

Next to the Mendoza is the Tunuyan, which takes its rise at the base of Tupungato, between the eastern and western ranges of the cordillera; flows first to the southwestward, then to the southeastward, and issues to the plain about seventy-five miles south of Mendoza, where it turns to the eastward and receives several small streams from the mountains. About two leagues beyond Acorocorto it divides; the principal part running to the southward, and the rest joining the Desaguadero, ten leagues farther on, and after spreading out in marshes in one place, the water collects, turns north, and empties into a salt lake some ten miles in diameter, called the Bebedero. That part which goes to the southward receives the waters of the Diamante, Atuel, and some other smaller streams from the mountains, and is finally lost in a salt lake near the parallel of thirty-eight degrees.

The next is the Rio Quinto or Fifth river, which rises in the San Luis range, and runs southeastward to about latitude thirty-four or thirty-five, where it is lost in lagunas and marshes. It is possible that in rainy weather some of its waters find their way through, and form the source of the Salado, emptying to the southward of Buenos Ayres.

The Rio de la Laja, just to the eastward of Achiras—an inconsiderable stream—is also lost in marshes and lagoons. Then comes the Rio Cuarto or Fourth river, which takes its rise in the mountains to the southwestward of Cordova, and runs southeastward by the Villa del Rio Cuarto to a bend called the "Punta del Sance," where it turns to the northward of east, and enters the Rio Tercero near the village of Saladillo, being considerably smaller at its junction than at the Villa del Rio Cuarto, and in dry weather quite salt.

About ten miles east of the "Villa" there is a small stream called the Chucul, which runs to the southeastward, and spreads out in marshes and lagunas near a place called "Las Chilcas,"† not far from the Rio Cuarto.

Finally, the Rio Tercero or Third river, the last on the road before reaching the Paraná, takes its rise in the same mountains as the Rio Cuarto; follows a course nearly parallel with it till the two unite; then runs more easterly as far as the post-house of Los Desmochados, where it turns to the northeastward, and at length empties into the Paraná.

It is almost unnecessary to say that the Paraná is a second Mississippi; which, together with the Uruguay, forms the Rio de la Plata.

It will be seen, on referring to the narrative, that the Mendoza, at the ford, was divided into three streams of about three, ten, and four yards wide, respectively, each a foot or eighteen inches deep; that the Tunuyan, before it divides, was about one-third of a mile wide, full of sand-flats, and apparently shallow; that the Desaguadero was four yards wide and eight inches deep; that the Quinto, on the first journey, was about twenty-five yards wide and two feet deep, and on the second, twenty yards wide and eight inches deep; that I found the Cuarto, on the first trip, sixty yards wide and two feet deep, but full of marshes and sand-flats at the first

* Mr. Darwin calls this the Luxan.

† There is one hut near this; but except that and a thicket of bushes called chilcas, there is nothing to justify the application of a name to the locality.

ford, while at that near Saladillo it was only fifteen yards wide and two feet deep; and that on the second it was near the same at the latter ford, but much smaller at the Villa del Rio Cuarto: and, finally, although the Rio Tercero, in consequence of a freshet, is noted as full and deep on the first journey, yet, on the second, we forded it two or three times, and found it but twenty-five yards wide and one deep. None of these streams have an outlet, except the Tercero and its tributary the Cuarto; and in consequence of their shallowness, none of them are navigable but the Tercero, and this only for a short distance in time of a freshet.

While in Mendoza, besides the project of a railroad to Rosario, the subject of a canal was under consideration; and one or two persons were desirous I should give them the results of my barometric observations, as also my views of the practicability of cutting a canal. As I am not a civil engineer, I am unable to give accurate information upon the subject, but think it probable that, by throwing the water of the Mendoza into the Tunuyan, this again into the Quinto, by a detour to the southward to avoid the San Luis range, and finally the Quinto with the Rio de la Laja into the Cuarto, a water communication could be made nearly all the year from Mendoza to Rosario. But I do not believe it would materially benefit the country if constructed. Increased facility for transportation would induce greater activity in agricultural pursuits, and consequently more water for irrigating would be needed, and this could not well be spared from the canal. As regards a railroad, nothing is wanted but timber and money, the country being highly favorable. The best quality of timber is said to abound in Paraguay, and I suppose the expense of rafting it down would be small; but, with respect to money, the country is entirely too thinly settled for such a work to be accomplished by private enterprise, and, to judge from present appearances, it will be long before the government of the Confederation will sufficiently recover from the effects of civil wars to enable it to undertake the work. The Mendocinos, however, are very sanguine about the matter.

Of animals, the most common, from Mendoza to Buenos Ayres, are the biscachas. These are about the size and color of the badger, but stand higher from the ground. Their heads are short, and formed like those of rats; and on each side of the face there is a black streak, which gives them the appearance of wearing regulation whiskers. Both upper and under jaws have two very large gnawing teeth. They live in communities, in burrows, which consist of one large apartment with chambers or nests running off from it, which are kept very clean. One of their peculiar habits is to collect round the entrance to their holes all the bones and skulls found near—with what object it is difficult to guess, if it be not to warn horses and cattle, for in case a careless animal should knock down their edifice, they have the labor of repairing it.

The first joint of the hind legs of the biscacha has a hard, callous sole on its under side, and this serves him for the purpose of locomotion, which is effected by springing like the kangaroo—the hind feet appearing to be of no service, except for throwing out dirt when he is digging.

A singular bond of union exists between this animal and the little owl of the pampa. One or two of these birds are nearly always found sitting at the entrance to the biscachera, and, when alarmed, give a harsh cry, and either fly off a short distance or take refuge in their holes, which are just inside of the entrance to the biscacheras—the porter's lodge, as it were.

The biscacha is seldom seen out of his hole in the day-time.*

Deer and guanaco are very common on the pampa, and are generally found feeding near the lagunas. Their flesh is rank and unsavory, and they are considered of very little value except for their skins. The mode of capturing them is with what are called "bolas," two or three round stones covered with raw-hide, and connected together by braided or twisted hide-cords. Where two stones are used, as among the Indians, the cord is about six feet long; but where there are three, each cord is three feet long, and the three cords are connected at their ends. The hunter, armed with bolas, depends on the fleetness of his horse to overtake the game; and on

* This animal is distinct from the biscacha of the cordillera, which is smaller, and more nearly resembles the squirrel, having a longer and more bushy tail than the former.

arriving at a convenient distance, takes one of the balls in his hand, swinging the others swiftly round his head until they have acquired sufficient momentum to throw them. If they strike their object, the balls wind around its legs, and trip it. Balls used for catching deer or ostriches are about the size of a hen's egg—those for horses as large as the fist; and I have seen them thrown about a hundred yards from a horse at full speed—the speed of the horse being, of course, an advantage, when the balls are thrown in the direction of his motion.

In the wooded country between Mendoza and San Luis, an animal called the liebre* is very common. It stands about eight inches high, and has a body two feet long. It is nearly the color of the biscacha, except that the lower part of its rump is white and the upper almost black. Its tail is a very small affair without hair, and resembles the stump of a rat's tail. In its wild state the liebre is very timid and difficult of approach; but when taken young, is easily domesticated and becomes very familiar, readily approaching the hand for offered food. One that I saw in Mendoza had a vile habit of turning round suddenly, when annoyed, and ejecting its urine. This, however, not being odoriferous, was not offensive, except as a mark of contempt.

Lions and tigers are said to be common among the marshes, but I saw none of them.

We saw one polecat and two or three iguanas, but whether they are common or not I do not know.

Lastly, there are found armadillos, and a small animal called pichiciego, something between the armadillo and the mole. There are at least three species of the armadillo; the most common of which are the *peludo*, or hairy, and the *pelado*, or bald—from the fact that one kind is covered with thin hair, and the other is without it. The third species I only saw near Mendoza; it is smaller, and is covered completely, except on its belly, with a flexible shell which the others have not. All of these, although common, are seldom seen, as they live in burrows.

The pichiciego—so called from the Indian word *pichi*, meaning small, and the Spanish word *ciego*, blind—has a coat of armor similar to that of the smaller species of armadillo over its back and on the top of its head, and on its sides and belly very fine white fur. As you have one of them in your possession, it is unnecessary to say anything more about it, except that even in Mendoza it is considered a great curiosity, and is not found, I believe, except in the wooded country near the base of the Andes.

Of birds, the ostrich is found throughout the country, but principally on the open pampa. It is very shy, but its young are easily tamed.

The large partridge is also found entirely across the continent, but is most common in the wooded country between Mendoza and San Luis; while the small partridge is more common to the pampa. Parrots and paroquets are also common to the wooded country.

The mocking-bird (or calandria) and the scissor-bird (tijeras) are found wherever there are trees. There are several kinds of small birds in the prairie grass, but they generally keep out of sight. The principal of these is a black-bird and a kind of bastard canary.

Around some of the lagunas swans, flamingoes, ducks, waders from the largest to the smallest size, and beach plover, are common. There are also very large birds of the buzzard kind, with a good deal of white and black about them, but I never was near enough to examine them; and over all the plain the carrancha (or traro, as it is called in Chile) and the horn-plover are common.

* Liebre literally means hare, but the animal is the Agouti of Patagonia.

CHAPTER VII.

FROM MENDOZA TO SANTIAGO AND BACK BY THE PORTILLO PASS, AND RETURN HOME.

LEAVE MENDOZA.—LUJAN.—SINGULAR PHENOMENON IN THE VALLEY.—TAME OSTRICHES.—PASSPORTS.—ARENALES.—SINGULAR WATER-FOWL.—VEGETATION.—EASTERN PORTILLO.—LA OLLA.—FUEL.—VALLEY OF THE TUNUYAN.—FATE OF A FAMILY CAUGHT IN THE VALLEY.—WESTERN PORTILLO.—PATH DOWN.—SINGULAR APPEARANCE OF THE HEAD OF THE VALLEY OF THE YESO.—BARRIER RANGE.—LADERA DE SAN FRANCISCO.—RIO MAYPU.—PROSPEROUS CONDITION OF THE COUNTRY.—CONTRAST WITH THE EASTERN SIDE.—SAN JOSÉ.—RIDE TO SANTIAGO.—ANOTHER CHARACTERISTIC OF CHILE.—RETURN TO SAN JOSÉ.—SNOW-STORM AT THE OLLA.—LODGINGS IN THE MOUNTAINS.—PASS THE EASTERN PORTILLO IN A SNOW-STORM.—PUNA.—INVULNERABILITY OF ARRIEROS.—ARRIVE AT MENDOZA.—DON SANTIAGO ARCOS.—CONVENTION OF INDIANS.—INFORMATION OBTAINED FROM THEM.—COLONEL RIVAROLA.—EXECUTION OF FIVE MEN.—BOILING-POINT APPARATUS.—SET OUT FOR SANTIAGO BY THE USPALLATA PASS.—OUR PARTY.—VILLAVICENSIO.—USPALLATA.—SPECIMENS OF NATURAL HISTORY.—ALMOST A DISASTER.—CRUPPERS NOT USED.—NATIVE MOUNTAINEERS.—ADVENTURE WITH A SNAKE.—GOITRE.—EXPENSES OF THE TWO TRIPS ACROSS THE MOUNTAINS.—THE CITY.—RETURN HOME.

After completing all the work to be done in Mendoza before the arrival of my baggage, I learned from a courier that he had passed, near the Rio Cuarto, the train of carts by which I had shipped it; and, knowing it would not arrive under twelve or fourteen days, I determined to occupy the spare time by going over the Portillo Pass. For this purpose I employed an arriero to take myself and servant, with one load of baggage, to San José de Chile and back; and to remain there long enough for me to visit Santiago and make a set of observations for clock error.

On our arrival at Mendoza the Frenchman took charge of the hotel, but found that more money went out than came in, and when he learned I was going, became so unhappy that I consented to the arriero's taking him, making such a bargain between themselves as they could agree upon, for I was tired of paying his way. I do not know that I would have had so much feeling against the man if it had not been that, in consequence of his wearing green spectacles, and being idle when I was at work, he generally passed for the "patrón," while I was considered his steward or assistant.

Before setting out on this journey I took the precaution to engage another arriero to take me over the Uspallata Pass on my return, in order that he should have his animals in good condition.

We left Mendoza on the evening of the 6th of December, and, passing through the village of San Vicente, stopped for the night at a place called La Cruz de Piedra, three leagues south of Mendoza.

December 7.—A league farther brought us to the outskirts of the town of Lujan, and thence one league through it to the Rio de Mendoza. Crossed this stream where it is divided into three parts, each about ten yards wide and one foot deep; and two miles farther from there, through cultivated land, we were in a thinly-wooded and uncultivated country. At the nominal distance of eight leagues from Lujan we entered on a rocky range of low hills parallel with the cordilleras, and, after travelling three leagues, crossed them; then two leagues across a valley to the skirt of the mountains, where we turned to the southward. From the skirt we saw a singular phenomenon in the plain. At times there were in view as many as twenty columns of dust carried up by whirlwinds to a considerable height, and moving about rapidly in different directions.

The valley is crossed by a number of streamlets, and has houses and farms scattered about it pretty thickly—the presence of those in the distance being indicated by rows of Lombardy poplars. Stopped for the night near one of these, and the next morning—December 8—went on six leagues farther, to a rancheria called La Arboleda, where we stopped at a rancho owned by relations of the arriero.

At the distance of five leagues from our last night's stopping-place we crossed the Rio de las Tunas, a tributary of the Tunuyan. Its bed is extensive, and the stream divided into six streamlets, each about two yards wide. Country thinly wooded with jarillas, chañares, and an abundance of cactus bearing the prickly pear, which is called tuna—hence the name of the river.

As it was snowing in the mountains, we employed the remainder of the day in preparing charqui, killing and cleaning a sheep to take with us, smoking, and sleeping. During the afternoon two of the men went off to look for nests, and returned at sunset; one of them, by tracking an ostrich, having found a nest containing eighteen fresh eggs.

In a garden belonging to the rancho there were eleven tame ostriches, which laid their eggs very regularly, but did not breed.

December 9.—Set out early, and, after travelling seven miles in a southwesterly direction across a thinly-wooded and stony plain, arrived at the point where the road enters the mountains. Thence a ride of two miles farther brought us to the banks of a rapid stream called the "Arroyo Grande," along which, sometimes on one side and then on the other, but always gradually ascending, we reached the "guardia" or custom-house, about eight miles from the plain. The only other house on the road after entering the mountains is a small hut occupied by men who cut out drip-stones from a quarry at the base of a white hill on the left. Crossed a streamlet from the southward and a short ladera.

At the guardia it was necessary to show our passports, always a disagreeable business, but which in this instance was particularly annoying. I had called on the chief of police before leaving Mendoza and told him I was merely going across the mountains by the Portillo Pass for the purpose of measuring their heights, but would return immediately, and wished to know if it was necessary to take out passports except for my final trip. To this question I received the very abrupt answer, "As many times as you leave the territory of Mendoza, just so many you must pay for a passport"—or, in other words, give five dollars for myself and seventy-five cents on account of my servant for the privilege of leaving such a miserable country; and I am not sorry to state, in this connexion, that I owe the government of Mendoza the sum of five dollars and seventy-five cents, for the officer at the guardia was so drunk that he forgot to endorse the document, and it served me on the next trip across the Uspallata Pass.

From La Guardia we proceeded eight miles farther along the south bank of the "Arroyo Grande," and as it was snowing in the portillo we stopped at a part of the road called "Los Arenales." We passed a deserted hut, two streams from the southward, and one from the northward, after leaving the guardia.

This place is about eight thousand two hundred feet above the level of the sea, with high snow-capped mountains on each side; and as a strong bleak wind was blowing from the eastward, we found it cold in the shade and too warm in the sunshine. When we attempted to make it warm in the shade by building a fire, the wind blew the smoke into our eyes and drove us out, so that there was no comfort.

Having nothing else to amuse me, I occupied myself observing some curious looking ducks disporting themselves in the stream. They were about the size of teal. Those I supposed to be males, because they were larger, were dark on the breast, had white heads and tails, chocolate-color on the back, and red about the roots of their bills. The females were slate-colored on the back, and brownish-red on the breast; their bodies and tails were long, and, with the exception of the short legs, their form resembled that of doves. They appeared to have power to fly but a short distance, but had great facility in crossing, ascending, or descending the rapid stream. The larger or male bird appeared to take more care of the young than the female, and it

was curious to see their manœuvres to get them out of danger when alarmed. One of the two would go down stream a yard or so, apparently making a survey of its rapids and eddies; then perch itself on a rock and call the attention of its companion, upon which the latter would leave with the young under convoy, go over the first waterfall, take refuge in an eddy, and finally climb on the rock with the brood. As soon as the pioneer saw that all were safe, it would proceed to examine the next fall, and in this way they moved off down stream very rapidly, pitching at times over waterfalls of five or six feet.

December 10.—Set out at 5 A. M. for the portillo, and at the distance of half a mile crossed a stream from the southward, whose banks are both high and steep, the descent to and ascent from it being difficult: hence its name of "El Mal Paso"—the bad pass. Crossed to the north side of the Arroyo Grande, and about four miles farther on recrossed it and turned to the southward at the base of a high hill. Wound to the southward of this for near two miles over a mass of angular rocks from the size of a hogshead to that of the fist, the only sign of a pathway being that the sharp edges of the rocks were a little travel-worn. We here saw the last of vegetation. From the Mal Paso we had had only low thorny shrubs among the rocks, and a beautiful green velvet-looking turf on the smooth spots of ground. This turf was only velvety in appearance, for on the occasion of adjusting our saddles, some of us, invited by its soft look, seated ourselves for a comfortable resting spell, but were forced to spring up in all haste, by finding that each particular twig carried a sharp thorn.

After tightening the saddle-girths we commenced the ascent of the first back-bone in this part of the mountains. This was slow work, for although the steepness of the road was overcome by zigzags, the rarity of the atmosphere made it necessary to allow the mules to stop every fifty yards and breathe. Fortunately, the sun had melted a great part of the snow, and the path was easily kept, so that we arrived at the portillo about nine o'clock A. M.

This range, as well as the western, has a break in the pass over which the road leads, which has the appearance of a gate-way; hence the name Portillo—a gap or breach. Its elevation is about fourteen thousand three hundred feet above the level of the sea.

Although the snow had melted to a great extent on the eastern side, the western was completely covered two or three feet deep, and was withal much more steep, so that the prospect to those of us who were uninitiated looked to be full of dangers and difficulties; but at length—on foot, stumbling and wallowing in the snow-drifts—we reached the base without any damage. From the foot of the "back-bone" our road was again over sharp, angular rocks and stones along the south side of the stream flowing to the westward. At noon we stopped on its banks at a part of it called La Olla. Vegetation here commences, and consists of very thin pasturage, with occasional clumps of those thorny little shrubs I have spoken of as limiting vegetation on the eastern side. This shrub is called, I think, "Cuerno de vaca"—Cow's horn—and is invaluable in the mountains for fire-wood; its roots being large and easily torn up, and very combustible. With the exception of mule's dung, or the back-bone and skull of an ox not long dead, this is the only fuel to be found.

After dinner we crossed to the north side of the streamlet, and as its course is very precipitous, coasted the southern skirt of the spur bounding it for three miles, when we descended its point to the valley of the river Tunuyan by a steep path. This stream, which comes from the base of Tupungato to the northeastward, here joins another from the west, and then turns to the southward. At the ford, the Tunuyan is about twelve yards wide, two feet deep, and very rapid; the other stream, from the westward, is eight yards wide. After crossing the Tunuyan we travelled eight miles farther, and camped on the north bank of its tributary, nearly opposite a high and singularly castellated mountain called the Palomares, at the base of which there is a square jutting rock, hollowed out in such a manner as to present the exact appearance of a house.

Passed several streams entering the "tributary" from both sides. Hills not very steep, but high enough to shut out the view of the lofty ranges back of them, so that it was difficult to realize that we were in the middle of the cordillera. The valley is thinly covered with pasturage,

and it is usual for drovers to stop there in order that their animals may recruit. It has no houses in it, but there are several small "corrals," or yards, built by arrieros and drovers. We saw a party of French artisans bound to Chile camped here, who had organized themselves for the journey before leaving Buenos Ayres, and, as a matter of economy and speculation, had bought some eighty mules in Rosario and on the road, some of which they used and drove the rest along. They had only two peons to aid them in the care of the animals, and performed all other work themselves. Their intention was to remain there until the mules were in good condition, and then cross the second range into Chile, where they expected to sell them at such a price as to make their trip profitable rather than expensive.

It is very well to stop in the valley of the Tunuyan for this purpose, in the first part of the season—for, although a snow-storm may come and block up the passes for a few days, the summer's sun is certain to open them again before long—but in the fall of the year it is highly dangerous. One storm succeeds another so rapidly, that there is no escape till summer comes again; and as the passes are generally closed nine months of the year, even supposing the traveller to have plenty of food, he could not exist such a length of time amid the snow. Some few years ago a family, consisting of several gentlemen, ladies, and children, were caught here by a snow-storm. At first, they supposed the detention would be temporary; but, as day after day passed, their hopes gave place to fear, and at length the arriero—the only one of them all who knew the road, or was, as they say, "vaqueano"—under pretence of examining the pass, left them, and never returned. As he was never heard of, it was supposed that, in attempting to escape alone, he was lost over some precipice. Their situation was now desperate; winter had fairly set in, and their provisions were failing. They therefore determined, as a last resort, to attempt to reach the plain by following the Tunuyan. Killing one of the mules, and providing themselves with as much of the meat as they could carry, they set out. I forget how long it was, but think that some weeks afterwards two or three of the party reached the plain, half starved, naked, and covered with sores; the others had perished. They were for a while as badly off in the plain as they had been in the mountains. There were no habitations near, nor any kind of food to be had; but, by good fortune, they fell in with a flock of condors feasting on a dead mule, from which they supplied themselves with a sufficient quantity to last them to the nearest house, where they arrived looking so wretchedly that the people were frightened and ran away. It was only by kneeling, and clasping their hands in the attitude of prayer, like Captain Riley and his men, that they could induce the residents to return and supply their wants.

I wish I could tell this story as it was told to me; but for a proper appreciation it is necessary to be as I was when I heard it, in the valley of the Tunuyan, with a snow-storm raging above me.

December 11.—Passed an uncomfortably cold night. Thermometer at 5 A. M. 29°.5; wet-bulb, 24°.

Set out at 5.30 A. M., and travelled about four miles along the north bank of the tributary to a point where it forks at the foot of the western portillo; one branch entering from the westward and the other from the southward; thence one mile to a stream issuing from beneath several snow-bridges, where we arrived at the foot of the second spine of the cordillera. It is almost unnecessary to say that the road ascends gradually after crossing the Tunuyan. By reference to the table it will be seen that the bottom of the valley is nine thousand five hundred feet above the level of the sea, while the foot of the second portillo is near eleven thousand.

By nine o'clock we had accomplished the ascent to the western portillo, and were on a spot where we could stand with one foot in Chile and the other in Mendoza. The eastern side is not very steep, nor are there any dangerous places on it; but the western appeared very formidable, and experience proved that it did not belie its looks.

The elevation of this pass is thirteen thousand three hundred feet, and, like the other, there is really no level ground on it. The first step of the mule, after reaching the summit of the ridge, and passing between the high rocks forming the portillo, is downhill.

Greatly to my surprise, there was very little snow on the road, and that was lying in patches; the greater part of the mountain near being as dry as a desert.

After making a barometrical measurement for the elevation, we started down, and very soon found the road so bad that we had to dismount and descend on foot. Properly speaking there is no road, but the mere semblance of a mule-path, winding by zigzags down a spur whose surface is covered with loose stones which roll from underfoot to its base, threatening at times to end in a general avalanche of mules, men, and stones.

After about a league of zigzagging, we arrived at a little arroyo at the base of the steepest part, where we stopped to drink and rest. We again mounted here; proceeded two miles along the south side of this streamlet; then crossed the head-waters of the Rio del Yeso, which comes from the northeastward; and, a mile farther on, after crossing a spur from the northward, we entered the valley of the Yeso. The appearance of the valley hereabouts is very singular. It is covered with rocks of many kinds, decomposed and decomposing, and presents the appearance of an immense bed of half-slacked lime—not so much from the color of the rocks, although white predominates, as from their crumbling condition. Large masses of pudding-stone are to be seen, so far decomposed as to require only a slight blow to split them in pieces.

The account given of this singular place by the inhabitants of San José is, that some years ago, while the mountain-passes were closed by the winter's snow, a shock was felt like that of an earthquake, accompanied by a great noise from this direction; and on the opening of the spring the muleteers found the road blocked up.

The appearance of the surrounding hills does not warrant the belief that it was a land-slide; and unless due to volcanic eruption, it is difficult to conceive how such a state of things could have been produced.

Besides these decomposed rocks, the flats near the stream are covered with a white efflorescence resembling soda.

Two or three miles in a direction north of west over this kind of ground, brought us to a gorge on our right from which a streamlet issues. We here turned to the southwestward, and travelled about nine miles down a flat valley covered with vegetation, to a barrier range running from the high mountains on the north nearly across to those on the south, only separated from the latter by the Yeso, which, with the waters of its tributaries, passes between it and the foot of a high and rugged mountain, which I believe is the extinct volcano of Jan José. The road generally leads between the Yeso and the streamlet to the northward, but crosses to the south side of the former in front of a hill called the Cerro del Yeso, from which the stream takes its name. We saw a party of men there loading mules with yeso (gypsum) for the Chilean market.

Fording this stream was rather a formidable business. It was about eight yards wide and three feet deep, with a rapid current, and the loose and rounded stones of its bed made it very difficult for the mules to keep their footing.

On the north side, and about half way down the valley, there is a steep hill, with quite a plane front, crossed by several dikes nearly at right angles with each other, which give it the appearance of a field divided into small, irregular lots. In the corner formed by the barrier hill and the northern range there is a small laguna, around which were a great number of birds, principally waders, about the size of curlews, but with wings of a dark color, and white bodies. They are called piuquens.

About three miles (including turns) over the barrier hill, and one more across a small valley, brought us to the banks of a stream issuing from a deep ravine to the northward, where we camped for the night.

I regret that I did not measure the height of this barrier. It must be near a thousand feet above the valley, and in crossing appears to be almost interminable. The road is tolerably good, but there is a dangerous-looking ladera on it—the valley, on the one hand, being several hundred feet below, and the hill-side, on the other, uncomfortably studded with large boulders, which appear to be on the point of tumbling down. I could not help feeling nervous when I

reflected that we were in an earthquake country, and a shock would, in all probability, send such a shower of these from above as would sweep all before it. The arriero, to test how far a man might roll before he could stop himself in the event of a fall, dislodged a loose rock from the road-side, and from the antics it cut on its way down, concluded that he would walk in preference to trusting himself on the mule.

December 12.—Started at daylight, and proceeded eight miles down a ridge separating the Yeso from the Manzanito—the stream on whose bank we had camped. We here found thin pasturage and shrubs, and at the end a low growth of Maiten and Quillai trees. In one or two places on this ridge the road approaches within a foot of the precipitous banks of the Yeso, and is dangerous.

Forded the Manzanito, and a hundred yards farther on, another stream, called the San Nicholás—both entering the Yeso from the northeastward. These streams are rapid, about ten yards wide each, and from one to two feet deep, with rocky bottoms. My mule fell on his knees in one of them, but fortunately recovered himself without any harm being done. Thence five miles along the bank of the river brought us to a ruined hut, called El Manzanito, after passing which we crossed the ladera de San Francisco—without question, the worst place in the cordillera. There are two roads from the hut, but we did not know it at the time, and instead of taking the upper, which, although longer, is good, we followed the lower one over the ladera. This is in very few places more than two feet wide, and in many not one—the hill sloping at an angle of twenty degrees with the vertical, and the river rushing and roaring over the rocks at the distance of near two hundred feet below. The descent from the ladera is very steep, and the zig-zags so short, that the mules had hardly time to recover themselves in one stretch before it was necessary to turn abruptly down another. At the end of this perilous pass the road leads for a short distance along in the edge of the stream, and then ascends its bank to more level country. About a mile and a half farther on is the junction of the rivers Maypu and Yeso, where the latter, although the larger of the two streams, loses its name, and the whole, to its mouth on the Pacific coast, is called the Maypu.

We were now at the beginning of settlements. Cultivated lands, fruit-trees, comfortable huts, smiling faces, bright eyes, and every indication of industry and superior intelligence, notified us that we were really in Chile. No contrast can be greater than the two sides of the cordillera in nearly all these respects. Nature, in the first place, has been more bountiful to the Chilean side. Where there is soil enough on the rocks to cultivate, there is water for irrigation; and an almost total absence of political strife or feeling among the inhabitants remote from large towns, has left them nothing to think of but the improvement of their worldly condition. A good market for their produce is at hand, and good roads lead to it; so that there is no excuse, except laziness, to prevent them from availing themselves of its benefits—and the Chileans are the least indolent of any of the Spanish race.

We passed a settlement of five or six houses called San Gabriel, crossed an arroyo, and stopped for dinner at a rancho by the roadside. After dinner we started for San José, crossed a hill to a gorge from the northeastward, and then a ladera to another from the southward, out of which comes a stream. There is here a foot-bridge over the river. Crossed a stream about twelve feet wide, by a bridge; then passed behind a hill called the Divisadero; and from there we had quite a long stretch to another point where there is a suspension bridge across the river. Ranchos, farms, and orchards on both sides, of course, and hills high, but gradually decreasing. About five o'clock we reached the resguardo or deputy custom-house; had our baggage overhauled, and paid twenty-five cents for it; and from there proceeded through the same nature of country to San José, where we arrived at sunset, without causing any unusual stir among the inhabitants, for the reason that they were run half mad by the discovery of some rich silver mines in its vicinity.

We here turned the mules into a pasture-ground, in order that they might recuperate by the time of my return from Santiago. For the sum of four dollars the keeper of the fonda was

obliging enough to let me have two horses, one for myself and another for my servant, which was a great favor, considering the rush for the mines; and after these arrangements were made I went to bed, with the happy thought that I should be in Santiago next day. Just as I was getting into a doze the Frenchman came into the room, and, with the most lost-all-my-poor-relationish look and tone, requested that I would allow José—my servant—to take charge of his bundle, as it would be rather inconvenient for him to carry, walking. The poor fellow had not eaten any dinner, and as I was in too good a humor to stand on trifles, I told him to get a horse and dinner, and I would pay for them. This was done, and by four o'clock next morning the three of us were off again; slowly at first, but at a gallop as soon as daylight showed us the nature of the ground over which we were travelling. About five miles from San José we crosed the Rio Colorado by a bridge, and thence followed the Maypu through lanes bounding farms and houses to the plain of Santiago. For further information regarding streams crossed or passed, I refer to the map.

I have spoken of the prosperous appearance of the country as a distinctive feature of Chile: before arriving at Santiago I saw another and very common characteristic in the person of a sturdy beggar priest on horseback. This particular one was very familiar to me, for there was seldom a day during our residence in Santiago that I did not see him, as then, riding along in his blue dress of the order of San Francisco, with a blue umbrella over his head, and a saint in a glass case under his arm.

All my efforts to prevent José from dismounting and having a kiss at the saint were ineffectual, and when I saw him pay a real for the privilege I was disposed to discharge him on the spot. However, it was the "costumbre del pais," as they say, and so I let the matter pass.

On arrival at Santiago, I rode along the well-known street behind Cerro de Santa Lucia, and stopped at the house of Don Carlos Moesta to make arrangements for making a set of observations in the observatory, but to my regret learned, from the lady of the house, that Moesta was away, and the observatory closed; and afterwards ascertained that the object and eye glasses of the telescope had been taken out for safe-keeping, and were "nobody knew where." Fortunately Mr. Mowatt, of Valparaiso, was in Santiago at the time, and had a pocket-sextant and an artificial horizon with him, with which I made the necessary observations.

The remainder of the day of our arrival and all the next were passed in a whirl of giving salutations to and receiving them from old friends and acquaintances, who appeared as glad to see me as I certainly was to meet them; and on the following morning—the 15th of December—we turned our backs on Santiago again. The twelve leagues to San José was accomplished at a slashing pace, and on reaching there we found the arriero ready and anxious to be off; so, changing from horses to mules, we started for the portillo.

From the time of our first arrival in San José until daylight of the third day afterwards, when my servant turned me out for the purpose of saddling up, everything had passed so rapidly as to appear a dream, and I was at a loss for a while to determine whether I had been in Santiago or not; but when I felt my bleeding heart, and got the scent of French brandy from my pocket handkerchief, I knew that all was reality, and that the confused images of Doña Cualquiera and Don Antonio were tangible facts.

Nothing worthy of remark occurred on our return trip until we arrived at "La Olla." We stopped there at three P. M. of the 17th for dinner; but as it was evidently snowing in the pass, I called a council of war to determine whether we should proceed or not. The arriero thought we could cross before night; the peon—who was really the only one among us acquainted with the road—was non-committal; I myself, resting my judgment on notes of the first trip, stated just how long it had taken us to accomplish the passage; so that my servant had the casting-vote. I told them, however, that if they thought it imprudent to attempt the pass, they must go to work at once and collect fire-wood, as we were likely to have a cold night of it, and very soon learned the result of their deliberations by seeing them busily engaged rooting up the shrubs which serve for this purpose in the mountains. In a short time we were

all seated around a bright fire drinking tea, smoking cigars, and telling stories to enliven the time.

By sunset the snow-storm, which before had only raged in the eastern portillo, became settled and spread over the whole valley of the Tunuyan. Our preparations for the night were necessarily the same as usual; but for the benefit of the curious, it may be well to describe them. The arrieros, in crossing the mountains, at convenient stopping-places have selected some rock, or rocks, affording shelter from the wind, and on their lee sides have built out short walls of loose stones, so as to make the shelter more perfect; the rubbish being then cleared out, and the surface made as smooth as possible, a bed-place was ready. Chileans have so many sheep-skins on and under their saddles, that their beds made in such spots are not at all uncomfortable; but the Mendocinos have seldom more than two or three sheep-skins, and perhaps a pair of ponchos or blankets; and yet with these they appear to be comfortable on the coldest night. I think that was about the amount of bed furniture each of my party had; and it was a matter of surprise to me to find that they suffered less than I did. My own bedding consisted of an ox-hide on the ground, two sheep-kins, a saddle-blanket, and one other spead upon it to make a soft bed; a thick blanket and a poncho for covering, and of course all my clothes, for these I never took off. Yet with all this, I frequently suffered with cold.

December 18.—It turned out very well that we remained at the "Olla," for by sunset the cordillera* looked so black and threatening that we congratulated ourselves on not having attempted to pass. It snowed lightly all night; but this, instead of being an inconvenience, was a comfort; my blankets were thick enough to turn water, and the coat of snow that fell on them kept me as warm as I had ever been in the mountains. When we set out, it was not snowing at the "Olla," and appearances seemed to indicate that it would clear up; but before long it commenced to snow again, and a northeast wind sprung up, which drove the drift into our faces with such violence as almost to blind us. As we advanced, we found that the fall of snow had been so great as to obliterate entirely the path, and we were obliged to feel our way with great caution. At the foot of the portillo it lay from three to five feet deep in the road; and in going up, the peon—who kept ahead to open the track—found that his mule was too much frightened to proceed. It was, therefore, necessary for him to dismount and open the way on foot; through which we floundered along on a hill-side whose angle with the vertical is near forty degrees, without knowing whether the next step would not take us into eternity; but placing our trust, after Providence, in the sure-footedness of the mules, we succeeded in reaching the portillo. The wind there was blowing violently, and the drift-snow swept around us to such extent as at times to obstruct our view entirely; but enough was seen to prove that the descent was as perilous as the ascent had been, and therefore we concluded to go down on foot. The delay necessary to make a barometric observation gave the party time to get half way down before I started; and I had not gone far before everything began to look green around me, and a severe attack of the *puna* rendered it impossible for me to proceed until the arriero, who had seen me succumb, brought my mule back.

We found the place where we proposed to pass the night, if we had started the day previous, covered two feet deep with snow; and, indeed, from the "Olla" on the west side to the "Mal Paso" on the east—a distance of seventeen miles, or seven hours' travel—the whole country was covered with snow; so that if we had set out, in all probability we should have perished.

Rested and got dinner at "los arenales," and afterwards proceeded to the rancheria of the Arboleda, where we stopped for the night.

December 19.—I expected to be off for Mendoza this morning at daylight, but found that both arriero and peon were nearly blind from the effects of travelling over the snow. At first I supposed they were skulking; but on examining their eyes, I saw that they were really suffer-

*The arrieros call only the spine of the mountains the cordillera; so that although one may be near the summit, he is not yet in the cordillera.

ing very much, and applied the only remedy at hand—diluted laudanum—and by noon we were able to move on.

People of the country, and foreigners of little experience, are in the habit of speaking of the arrieros and peons as invulnerable to disease, and capable of enduring any quantity of hardship. To a certain extent this is true; but the secret of it consists in a constant and practical application of the Spanish proverb, "Si hay remedio, remediarlo; y si no hay, para que llorarlo?"—"if there be a remedy, apply it; but if not, where is the use of crying over it?" While out of reach of assistance, they bear up on this principle most manfully against all ills; but when aid can be obtained, they yield to a greater extent than an unaccustomed traveller would. For instance, when we were among the snow of the mountains, the arriero and peon were as brisk and lively as bees, whilst I was on the point of giving up entirely; but after our arrival at the Arboleda, where their ailings could be attended to, they yielded to an extent I should have been ashamed of.

At noon set out and travelled till night, and early the next morning commenced the last stage towards Mendoza. Before arriving, we met the peon of my other arriero, who was on the look out for me, and anxious to be off.

Reached Mendoza at mid-day of the 20th, and found that my baggage had arrived three days before. My friend Don Santiago Arcos had kindly taken charge of it, thus adding one more to the many favors I already owed him.

As I have mentioned this gentleman's name, it may be as well to state that he is one of the most intelligent men I ever met in Chile, but unfortunately his constitution did not suit the climate of that country; and his uncles, "Los Señores Varas and Valdivieso," had insisted on his removing to the more genial one of Mendoza. He was thus torn from all his associations and forced to live among strangers. This over-exertion of friendly compulsion may not be understood among our people, but in Chile, where the authority of a parent or guardian is absolute, it is looked upon as a matter of course.

Mendoza.—Between my first and second visits to this place, with a view of obtaining more accurate knowledge of its territory, the government had induced upwards of twenty caciques of the Indian tribes to the southward to come in and give information. My old friend Don Carlos was charged with the business of interrogating them and collating their reports; and attached so much importance to the data furnished that he was engaged in making a map of that part of South America, which he proposed selling to the British government or our own, and was evidently so unwilling for me to copy it that I did not care to press the matter. Indeed, from practical experience, I knew that information collected in this way was so little reliable that I was not disappointed by his reluctance to have me forestall him in the work. Twenty Indians all speaking different dialects, and with knowledge of neither north, south, east, nor west, except by the rising and setting of the sun or other heavenly body, nor any idea of distance but that which depends on the condition of their horses, could not be expected to give information sufficiently exact to insert in a geographical map.

There were some things, however, that they all concurred in, and, as I was able to obtain the pith of these, I will give them:

First: that the Tunuyan, besides receiving the Diamante and Atuel, also receives the waters of a number of small streams from the cordillera; but, notwithstanding this increase, terminates in a salt lake, called on Parrish's map "Urre Llauquen," but which they called "Curraca;" that about one degree and a half north of this lake there is another, of fresh water, on the west bank of the Tunuyan; and that not far from latitude forty degrees south, nearly opposite the port of Valdivia on the Pacific, there still exists the ruins of an old Spanish settlement, where rich copper mines were formerly worked very successfully. On an invasion by the Indians, all the men were killed and the women and children carried into captivity, and from these has sprung a tribe with lighter complexion, more European features, and greater intelligence, than the other Indians of the country. They also stated that there was a well of

water thereabouts, to which it was necessary for them to make a pilgrimage once in their lives for the welfare of their souls; and a river, in which they were obliged to bathe whenever they passed. On these occasions they have a grand frolic in honor of the deity they worship; and when they have spirituous liquor, it ends by all getting drunk and having a free fight. This is the Indians' story, as furnished me by Rivarola, and I give it for what it is worth.

While I was in Mendoza, five men were shot for stealing cattle; they were old offenders, and the vice had become so general that the government found it necessary to make an impressive example.

On settling accounts with the cartmen for the transport of my baggage from Rosario, I found that the Frenchman, whose trunk was with mine, had made no arrangements to pay the freight, and that I was considered responsible for it. Having made up my mind in Santiago that I was finally done with the fellow, I felt so much annoyed at his conduct, that his trunk would have been left at the disposition of his creditors; but Arcos suggested that I should pay it in memory of Lafayette, and accordingly it was done.

I am inclined to think this countryman of the illustrious Lafayette was rather more knave than fool, for although he called several times after my last arrival in Santiago to see me, and talked over arrangements of accounts, his cash was not forthcoming at the proper time, and I never heard more of him.

On making my last set of observations in Mendoza, I discovered the reason why the boiling-point apparatus indicated a greater elevation than the barometer, viz: a portion of the mercury, by the jarring of travel, had lodged in the cell at the top of the tube.

On the 23d of December I again set out for Santiago by the Uspallata Pass, and shortly after leaving town found that my party, instead of consisting of myself and servant, with the arriero and peon, was increased by the sister of the arriero—Doña Juana—and a young Italian, a manufacturer of fideos, whom the arriero had contracted to carry over. As it was the last stage of the journey I made no objection, and had no cause afterwards to regret it. Doña Juana was a very good hand at making a stew or a cup of maté; and the Italian, although frequently of service to me, was so grateful for the little benefit I could render him that I cancelled a resolution, made on parting from the Frenchman, of never doing another generous act without a *quid pro quo*.

We stopped at nearly all my former stations, to repeat some of the observations, and finally arrived in Santiago, early on the morning of the 2d day of January. In looking over my notes of this journey, I find but few worth transcribing, and those I will throw in as odds and ends, without order or connexion, to fill up the seams of my loosely-worded report.

We passed a part of Christmas day at Villavicensio, and found that the place, under the influence of a cheerful sun and a feast day, was more pleasant than at our former trip.

Accomplished the journey between Villavicensio and Uspallata on the 26th, and stopped there, to give the peon a chance to recover from the effects of a kick from one of the mules.

Among the baggage left behind at Rosario was a chest, containing two tanks of alcohol, which I had volunteered to bring from the United States for the purpose of preserving specimens of natural history. When I found it necessary to leave my heavy baggage behind, I had made up my mind to neglect entirely this part of my original intention; but having the tanks with me on this last trip, I felt disposed to add a mite to that science, and accordingly offered one of the soldiers at Uspallata twenty-five cents each for every snake or animal he should bring. He was at first doubtful about my sincerity, but when I paid him fifty cents for a pair of mountain rabbits, set himself to work in earnest; and before long I had specimens of crabs from the river de Uspallata, several snakes, and at last near a peck of tadpoles, for each of which I was expected to pay twenty-five cents.

This was like my experience in Rosario. I there commissioned three or four men and boys to bring me specimens of snakes, fish, &c., but for two or three days got nothing. At length, when I had given up all hope, I was called out one morning, and found two fishermen from the

river, each one having ten or a dozen enormous catfish, which they had been instructed to bring me. As any one of the fish was large enough to fill my tank, I had, of course, to decline purchasing, very much to the annoyance of the fishermen and the indignation of my emissaries.

A short distance above the Puente del Inca there is another natural bridge, over the Rio de las Cuevas, formed by two large boulder rocks, which have lodged against each other, leaving enough space underneath for the water to pass. This bridge is made transitable, by having sheets of the rock of which the Incas bridge is formed laid like a pavement over its inequalities, and is frequently used by arrieros, in order to avoid the steep descent to and ascent from the Rio de los Horcones. With this view we passed the Puente del Inca, followed the south bank of the river, and recrossed at this bridge, where we were near having a serious accident. The ascent from the bridge to the road is by a short ladera; and as we were passing this, one of the burden-mules struck his load against a jutting rock, which partially turned it. As usual, the mule, on feeling all the weight on one side, became frightened, wheeled round, and came down the ladera at full speed, to the imminent risk of the whole party. He passed me so suddenly—the boxes grazing my knee—that I had no time to be alarmed for my own safety; but the chance for those below me—la Juana in particular, who was in a narrow part of the road, and so much frightened as to be incapable of exertion—appeared to be very small. My man, José, dismounted, and attempted to stop the mule, but was knocked over, and, in company with one of the boxes of instruments, went heels over head down the steep hill for about a hundred feet, both box and man bringing up at the river bank, without farther injury than a few bruises. Fortunately, before the mule arrived at the place where the woman was, the load had worked round under his belly, and prevented him from proceeding farther.

Notwithstanding the steepness of the path across the cordillera, cruppers are never used, between Chile and Mendoza, for saddle or burden mules; nor does this appear necessary, with native mountings. These are furnished with wide double girths, working in large iron rings at their connection with the saddle. One of these is placed under the breast, and the other well back, near the flank, and both are girthed so tight that the poor animal's belly is sorely pinched between them. In this position the saddle or load is immovable, forward or backward, until after a long march, when the animal becomes thinner by sweating. But, unless they are nicely balanced, the loads are constantly working over sideways, and as soon as the mule begins to feel the weight too heavy on one side it runs away, seldom stopping till the load gets under its belly and impedes progress, when it vents its uneasiness in kicks. In such cases, as also in loading, the first thing to be done is to blindfold the animal, without which it will not stand still. The arriero's poncho, or blanket, serves for this purpose, which is, indeed, one of its principal uses.

With an English or American saddle, where the girths are so arranged as not to admit of their being spread apart, there is frequent necessity, in going down hill, to halt and set the saddle back.

I find that no mention is made, in the first part of my narrative, of the existence of ruins of Indian houses in the Uspallata Pass. There are ruins in at least two places—at the Rio de Tambillos, on the eastern side, and near the Alto de la Laguna, on the western. Those at the Rio de Tambillos are the most perfect, and resemble the foundations of a large house. The walls are not more than three feet high, and it is difficult to understand what the nature of the structure was. Their use was probably the same as that of the casuchas. In the Portillo Pass there are several corrals or yards, that serve for a similar purpose; but these are not as large or of the same construction as the tambillos, and were probably built by drovers. These ruins are called "tambillos," which is the diminutive of the Peruvian word "tambo," meaning an inn.

Just before reaching the posada de Colina we discovered a snake, which my servant disabled by a cut across the back with the horse-whip, and it was afterwards choked until all signs of life were ended. Wishing to preserve it, and not caring to stop and unload the mules then, I put it

in my saddle-bags, intending to deposit it in the tanks at Colina. On our arrival I was astonished to find that it was not only alive and hearty as ever, but eagerly bent on biting me. Of course I dropped the reptile; and it soon made its way to a large party of women, who had collected at the posada to celebrate the new-year's day. The amount of squalling and fluttering of petticoats that took place, and lasted till I got his snakeship by the throat, may be better imagined than described.

I have said that it is the universal impression in Mendoza that goitre is caused by the use of the water of the river; it is also a very common belief in Santiago that it is there produced by the water of the Maypu. Indeed, many of the old inhabitants say it was not known before that water was brought to the city by the Maypu canal. There is a peculiar feature about both of these rivers which appears to justify this belief. Their banks are coated in many places with a white deposit, or efflorescence, called salitre; whilst the Aconcagua and Tunuyan—the one a companion of the Maypu, and the other of the Mendoza, which pass through settlements free from the goitre—have very little or no salitre on their banks. I took pains to bring home some of this efflorescence, and it is now in the hands of a chemist for analysis. There are also with the principal part of my baggage and instruments—which were left in Valparaiso for shipment around Cape Horn—two bottles of the water of the Mendoza, and two from the Tunuyan. On their arrival they will be analyzed, and, it is hoped, will give some information on this subject.

A striking change had taken place in the appearance of the outlet at the Uspallata Pass, on the Chilean side, between the time of my first and second journeys across it. On the former occasion there were but two or three huts below the Guardia Vieja, and around it there was no sign of cultivation; whereas, on the latter, instead of the one lonely hut at that place, there were quite a number, and several small farms; and from there to the valley of Santa Rosa there was almost a continuous line of farms and houses.

My expenses from Mendoza to San José and back, by the Portillo Pass, were eighty dollars, exclusive of food; and from Mendoza to Santiago, by the Uspallata Pass, fifty-four dollars. In the first case I had only two light trunks; and in the last, two loads and a half of baggage.

It may be proper to remark, that the accompanying map (No. 9) is compiled from others, except in the immediate vicinity of my road, where I have corrected it by observations. The map of the two mountain passes (No. 8) is entirely from observations; that of the Portillo Pass having been planned from estimated distances uncorrected, but the Uspallata Pass having the estimated distances corrected by positions astronomically determined.

I left Valparaiso by the English mail-steamer of the 15th of January, proceeded to Panama, and, after an unusual and harassing detention on the isthmus, returned to the United States by the first steamer.

Appended I give a table of the distances paid for on the post-road from Rosario to Mendoza.

I have the honor to be, very respectfully, your obedient servant,

ARCH. MacRAE,
Lieutenant U. S. Navy.

Lieut. J. M. Gilliss,
Supt. U. S. N. Astronomical Expedition.

TABLE OF DISTANCES, BY THE POST-ROAD, FROM ROSARIO TO MENDOZA.—ANALYSIS OF POWDER COLLECTED ON THE BANKS OF THE RIVER YESO.

PROVINCE OF SANTA FÉ.

From Rosario	to the Saladillo de la Orqueta	7	leagues.
"	Candelaria	5	"
"	Desmochados	6	"
"	Arequito	4	"
"	Guardia de la Esquina	5	"

PROVINCE OF CORDOVA.

to the	Cruz Alta	4	leagues.
"	Cabeza del Tigre	4	"
"	Esquina de Lovaton	5	"
"	Saladillo de Rui Diaz	5	"
"	Barrancas	4	"
"	Zaujon	4	"
"	Fraile Muerto	4	"
"	Tres Cruces	4	"
"	Arroyo de San José	9	"
"	Cañada de Luca	5	"
"	Tortoral	4	"
"	Guanaco	6	"
"	Tambillo	6	"
"	Chucul	8	"
"	Villa del Rio Cuarto	4	"
"	Ojo de Agua	7	"
"	Barranquitas	5	"
"	Achiras	5	"

PROVINCE OF SAN LUIS.

to the	Portezuelo	5	leagues.
"	San José del Morro	7	"
"	Rio Quinto	12	"
"	San Luis	12	"
"	Balde	9	"
"	Desaguadero	12	"

PROVINCE OF MENDOZA.

to the	Acorocorto	12	leagues.
"	Santa Rosa	20	"
"	Retamo	10	"
"	Mendoza	12	"

The effloresceut powder collected on the bank of the river Yeso has been analyzed by Professor J. Lawrence Smith, and found to consist of—

Sulphate of magnesia	40.10
Sulphate of soda	26.25
Chloride of sodium	33.65
	100.00

PART II.

OBSERVATIONS.

OFFICE OF THE UNITED STATES NAVAL ASTRONOMICAL EXPEDITION,
Washington, D. C., June 29, 1854.

SIR: I beg leave to submit herewith the results of my observations, made between Santiago de Chile and Montevideo, for the determination of geographical positions, elevations above the sea-level, and the magnetic elements; and, in connexion therewith, to present a statement of the manner in which they were obtained, and the amount of reliability to be attached to them.

OF THE LATITUDE.

The altitudes were invariably measured with a sextant and artificial horizon, and, as the sun's meridian altitude was too great for the sextant, the latitude has been generally derived from double altitudes—there being two or more determinations for each place.

In the months of November and December, during which these observations were generally made, the sun passes too near the zenith in the parallel to which my work was confined for very accurate determinations; but, from the close agreement of the results, I consider them sufficiently reliable for all practical purposes.

Mendoza, for example, was found to be in 32° 50′ 51″ by two altitudes.

		51	18	" "
		51	21	" "
		50	45	" "
		51	07	by meridian altitude of moon.
Mean	32	51	04	latitude of hotel.
+			11	
South	32	51	15	latitude of Plaza.

These results, however, agree more closely than the generality of them.

OF THE LONGITUDE.

On my first trip across the country I had three pocket-chronometers, only one of which was of the least value for the determination of longitudes; and on two occasions, although I wound the others, I neglected to wind that particular one. Having no known position from which to determine its error, and not time enough to ascertain definitively a position, I, of course, could not rely on it. Moreover, I made the mistake of marking time by it at all observations, and, by the necessary shifting from hand to pocket, vitiated its rate. I have, therefore, rejected all chronometric determinations of the first journey, except that at the Casucha de la Cumbre, at which place I did not stop on my second expedition. In this instance, taking the rate from the Alto de la Laguna to the Casucha de los Puquios, according to their positions as determined on the second journey, there is only to be considered a rate for about fifty hours, and, consequently, no probability of great error.

On the return to South America, I was better provided, and had more experience. In addi-

tion to the best of my former chronometers, P. & F. No. 1915, belonging to the government, I had Barraud No. $\frac{2}{653}$, also belonging to government, and P. & F. No. 2683, of my own.

Taking Rosario, on the Paraná, as my initial point, and assuming its longitude as determined by Captain Sullivan, R. N., in H. B. M.'s brig "Philomel," to be correct, I made as little delay as possible in reaching Mendoza, my first terminal point, making observations at several places on the road. The longitude of Mendoza was then determined by chronometric differences with Santiago, in the following manner:

The day of my departure from Mendoza, (December 6, 1853), and again on my return from Santiago, (December 21, 1853), I made observations for clock error. This gave me one rate. I also obtained observations in Santiago, on my first arrival from Mendoza (December 14, 1853), and again on my last arrival (January 3, 1854), which gave me another rate. The longitude of Santiago having been accurately determined by the observations of the "Expedition," I worked back from December 14 and January 3, to Mendoza, December 6 and 21, with both rates, and obtained the following results:

Barraud.	P. & F. 1915.	P. & F. 2683.	Means.
h. m. s.	*h. m. s.*	*h. m. s.*	*h. m. s.*
4 35 56.6	4 36 05.7	4 35 53.9	4 35 49.2
42.1	35 39.0	49.0	4 35 50.3
48.8	35 51.2	48.9	4 35 48.6
29.8 (*a*)	35 45.2	42.6	
4 35 44.3	4 35 50.3	4 35 48.6	4 35 49.4

Or, rejecting (*a*), 4*h.* 35*m.* 49.2*s.*

The last determination by Barraud is rejected; because, at the Estero de las Cruces this chronometer slipped from my pocket, and, although it fell on the sand, the jar was sufficient to alter its rate.

The longitude of Mendoza being thus determined to my satisfaction, I adopted the rate between that place and Rosario for all intermediate places; and between Mendoza and Santiago for stations in the mountains.

In order to judge of the amount of probable error in these determinations, I append the Greenwich mean time as shown by each chronometer, (with errors applied) at those points on the road where the greatest discrepancies existed:

Villa de la Concepcion, November 16, 1853—

	h. m. s.
Barraud . . .	7 55 12.0
1915	7 55 26.4
2683	7 55 32.4

Uspallata, December 26, 1853—

	h. m. s.
Barraud . . .	7 23 21.0
1915	7 23 26.4
2683 . . .	7 23 26.8

It may be as well to remark, that I carried all three chronometers in a belt strapped around my waist, and under my clothes. In this way they were kept at as near the same temperature during the journey as was possible.

As an additional proof of the accuracy of determinations of longitude by means of pocket-chronometers, I beg leave to recall to your memory the fact that Mr. Mowatt, of Valparaiso, determined the difference of longitude between Santiago and Valparaiso by this means in January, 1852, and that this difference was found to agree, within a very small fraction of a second, with our determination by electric telegraph in September, 1852.

Besides the chronometric determinations, I had also determinations deduced from the beginning and end of the solar eclipse of November 30, 1853; the observation of the end being very

good. I was disappointed, however, from not having any observations at other stations, with which to compare my own. The only place from which proper observations could have been expected was Santiago; and you are aware Dr. Moesta, the chief of the observatory at that city, was away for the purpose of making observations in Peru, where the eclipse was central. Moreover, the eclipse was very partial in Mendoza; and the result differs so much from the determination by chronometer, that I have not hesitated to reject it.

I have also rejected the observations of lunar distances in Mendoza and elsewhere. So far as my experience goes, they are, at best, only approximations; and where, as in this case, it was necessary to calculate the altitudes—thereby introducing another source of error—less dependence is to be placed on them.

I was unable to observe any occultations on either journey. When the star to be occulted was of sufficient magnitude to be observed with my ship's spy-glass, clouds intervened.

The positions of Santiago, Rosario, Buenos Ayres, and Montevideo, are not by my determinations; the first being by the "Expedition," and the rest from the best English authorities.

The longitude of Mendoza, by the observation of the end of the eclipse, is $4h.\ 35m.\ 04s.$

ELEVATION ABOVE THE SEA-LEVEL.

In these calculations, which have been made by the formula published by the Smithsonian Institute, it was necessary to assume a base; and for want of better I adopted Santiago, taking the mean of all observations at 9 A. M., noon, and 3 P. M., for the months of November and December, during which two months my journeys were made. Supposing the mean height of the barometer at the level of the sea, in Valparaiso, to be 30 inches, and the temperature the same as in Santiago, the corresponding difference of level is 1,793 feet; which I have applied to the calculated elevations above Santiago to obtain elevations above the sea-level. The only exceptions to this in the table are at Rosario, Acorocorto, and Tupungato. The difference of level between Rosario and Buenos Ayres is given by a comparison of all observations made in each place.

Acorocorto is so near the level of Santiago that there is doubt whether one of the temperature corrections is positive or negative; and I have, therefore, worked from assumed readings at Valparaiso. The height of Tupungato is calculated from a vertical angle measured from la Punta de las Vacas.

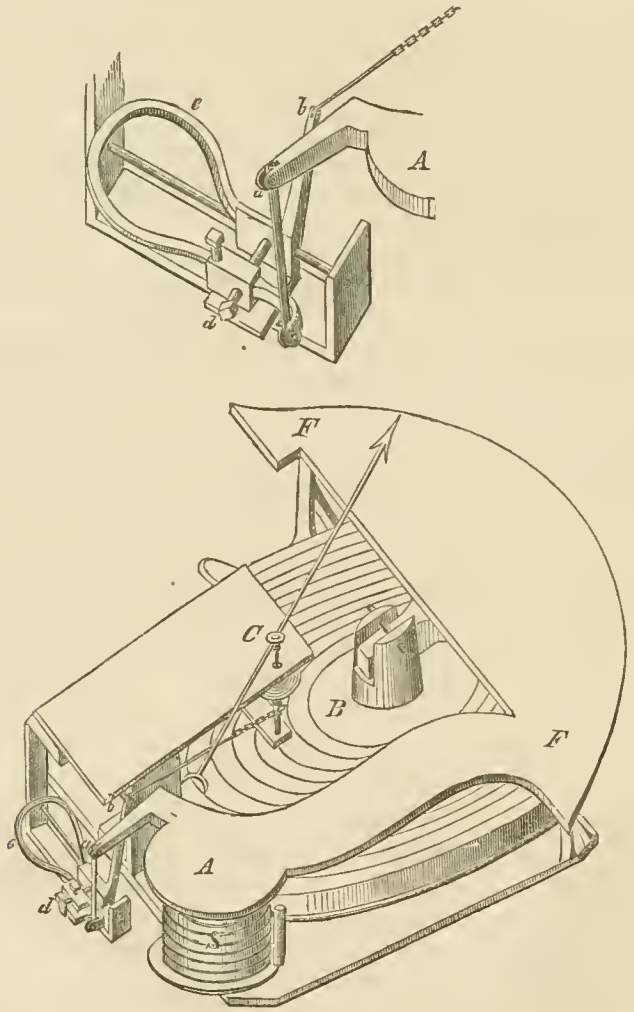
A glance at the table of heights will show the amount of reliability to be placed on them. In all places near the level of the sea the ordinary fluctuation of the barometer renders determinations of but little value. At the Villa de la Concepcion, for instance, the observations of the 16th of November give an elevation of 1,696 feet, and that at noon of the 17th gives 1,369 feet. For a proper understanding of the records in the column marked aneroid, it is necessary to state that on my departure from Santiago, in November, 1852, I had an aneroid, which I broke accidentally on mounting my horse the first day out. On the second trip I had another, which was compared daily, at Rosario and Buenos Ayres, with the mercurial barometer, and was not altered till I reached San Luis, where, from dampness or other cause, the dial, which was of pasteboard, had expanded so as to impede the motion of the index. It was necessary, therefore, to cut out the central part to allow free motion to the index, and probably in so doing the reading was altered. After obtaining careful comparisons in Mendoza, I left for Santiago by the Portillo Pass, and made corresponding observations with the syphon barometer as far as the eastern Portillo, where the final lever, *b*, (see figure,) had reached a horizontal position; and as it was not possible to wind up the chain, of course the barometer ceased to act. On the second trip from Mendoza I turned one of the screws *d* of the leverage apparatus *c*, until the lever was thrown back as far as possible. Though this gave it greater range for diminished atmospheric pressure, and I passed over the Uspallata Pass without having it cease to act, it was also without accurate measures; and, moreover, when I descended to near the level of the sea the lever was resting against the side of the case, and the barometer could rise no farther.

The difference between the reading of the aneroid and mercurial barometers in passing the cordillera, was as follows:

Mendoza	2.82	inches.
Villavicensio	2.53	"
Uspallata	2.38	"
Casucha de los Puquios	2.26	"
Casucha de la Cumbre	2.15	"
Alto de la Laguna	2.05	"
Estero de las Cruces	2.39	"
Chacra de Montumas	2.57	"

Showing a regular decrease of difference in going up, and, with the exception of the difference at the Alto de la Laguna, which may be a false record, a regular increase coming down. This proves that the aneroid, or at least the one I had, is not adapted for measuring heights.

It has been objected to the aneroid that it does not remain constant; that is, a comparison made to-day will not agree with one six months hence. I think the difficulty may be obviated in this manner:



Under the end A of the first lever A F F there is a spiral spring S, which rests on a washer connected with a screw in the back of the barometer, and intended to adjust the instrument by.

When this is screwed up enough to raise the washer off the base of the instrument, the hand may be regulated backwards or forwards by turning the screw, but at the same time the constant action of the spiral is against the washer, and will in time force it down, particularly when there is any jarring, as there is in travelling. I found that the comparisons remained constant when the washer was resting on the base of the instrument. It is to be remarked, however, that I made but a short series of observations.

MAGNETIC DETERMINATIONS.

The declination and inclination were determined in the usual mode, with a portable declinometer and Barrow's dip-circle. It is therefore unnecessary to say anything respecting them in this place, except that the observations for inclination are the least reliable of all. The axis of the needle has a shoulder on each side, of such short proportions that, in raising the needle between readings, if great care has not been taken to re-place it, the Y's only take hold on one side, and therefore, in returning it to its place on the agate supports, it is apt to lodge diagonally. I did not discover that this was the cause of the discrepancies until I had finished the work.

The horizontal force was determined from the usual data, by the formulae of Riddell.

The moment of inertia of the magnet found, by vibrating it with two different rings, and also without weight between the two sets of ring vibrations, to be equal to 2.66092, by the following formula:

$$K = K^1\left(\frac{T^2}{T_1^2 - T^2}\right)$$

Where K^1 is equal to the moment of inertia of the ring, and T and T_1 = the times of vibration with and without weight, T and T_1 were corrected by the formula—

$$T^2 = \left\{ T\left(1 - \frac{r}{86400} - \frac{a\,a^1}{16}\right)\right\}^2 \left(1 + \frac{H}{F}\right)$$

in which T = the recorded time of one vibration in seconds.

$\frac{r}{86400}$ = the rate of the chronometer per second; + when gaining; — when losing.

$\frac{a\,a^1}{16} = a^2\,d\,d^1 \times .000072722^2.$

d and d^1 denoting the semi-arcs of vibration in divisions of scale, and a the angular value of one division.

$\frac{H}{F}$ = the ratio of the torsion and magnetic forces.

$K^1 = \frac{1}{2}(r^2 - r_1^2)\,w$, where w is the weight (in grains) of the ring used, and r and r_1 the exterior and interior radii, in decimals of a foot.

The value so found is corrected for the difference of temperature between what it was when K was determined and the actual temperature at the time of observation, by multiplying it by $1 + 2\,e\,(t^1 - t)$, where t^1 denotes the actual temperature of the magnet, t the temperature at the time of the original observations, and e the coefficient of dilatation of steel for 1° Fahrenheit: the numerical value of e being 0.0000068.

The change of magnetic moment for a difference of 1° of temperature was found to be 0.000394, by the formula—

$$q = \frac{1}{t - t_0} \times a\,n,\ \text{co tan}\ u;$$

q denoting the temperature coefficient.

a denoting the arc value of one division of the scale in terms of radius.

n denoting the difference of scale readings, corrected for change of declination.

t and t_0 denoting the corresponding differences of temperature.

u denoting the angle of deflection at the lowest mean temperature.

With these constants, the horizontal force = X, and the magnetic moment = m, were found as follows:

$$\frac{m}{X} = \tfrac{1}{2}\left(\frac{\tfrac{1}{2}\, r^3 \sin u}{1+\frac{P}{r^2}} + \frac{\tfrac{1}{2}\, r_1^3 \sin u^1}{1+\frac{P}{r_1^2}}\right)$$

where r and r_1 = the distance between the centres of the deflecting and suspended magnets in decimals of a foot, u and u^1 = the corresponding angles of deflection

$$P = -\frac{r^2 r_1^5 \sin u^1 - r_1^2 r^5 \sin u}{r_1^5 \sin u^1 - r^5 \sin u.}$$

P was determined by the above formula, by taking a mean of twenty sets of observations at 1 foot and 1.3, including those made during the trip, and found to be equal to — 0.0022001. And this value was used as a constant.

$$m\ X = \frac{\pi^2 K}{T^2}$$

where π = Circumference of circle to diameter 1;
K = Moment of inertia of suspended magnet and stirrup;
T = the time of one vibration given by the formula,

$$T^2 = \left\{ T^1\left(1 - \frac{r}{86400} - \frac{a\,a}{16}\right)\right\}^2\left(1 + \frac{H}{F} - (t^1 - t)\, q\right)$$

These symbols being the same as those used in determing the value of K. And
t = temperature of deflecting magnet during the experiments of deflection.
t^1 = temperature of deflecting magnet during the experiments of vibration.
q = the temperature coefficient.

And finally, calling $\frac{m}{X} = A$
$m\ X = B$

$$X = \sqrt{\frac{B}{A}}$$

and $m = \sqrt{AB}$

While in Buenos Ayres I made observations, from early daylight till dark, for change of horizontal force, by taking the time of 300 vibrations every hour, but I neglected to observe the angle of deflection except at the beginning, middle, and end. At these times, viz:

At 6.30 A. M. X = 6.19309
At 1.30 P. M. X = .19886
At 6.30 P. M. X = .22289

At Santiago, the value given of X and m is the mean of several sets of observations immediately preceding my departure. At the Chacra de Montumas the observations were made about mid-day; at the Estero de las Cruces about 11 A. M.; at the Alto de la Laguna about 3 P. M.; at the Cumbre about 6 A. M.; at the Casucha de los Puquios about 6 A. M.; at Uspallata 7 A. M.; and at Mendoza about noon.

The total force was found by multiplying the horizontal force into the secant of the inclination.

In conclusion, I beg leave to state that from several causes it is difficult to make accurate observations in a mountain pass; the principal obstacles are, local attraction and strong winds. In the case of my observations, there was the additional difficulty of being obliged to make them in the sun, because the tent I had was of such construction that it was useless as a shelter to the instruments.

I think, however, the observations are sufficiently accurate to establish the fact that the magnetic force decreases with the altitude, but in what ratio I am unable to say.

I have the honor to be, very respectfully, your obedient servant,

ARCH. MACRAE,
Lieutenant U. S. Navy.

Lieut. J. M. GILLISS,
U. S. Navy, Chief of Expedition.

TABLE SHOWING THE LATITUDES, LONGITUDES, ELEVATION ABOVE SEA-LEVEL, AND MAGNETIC ELEMENTS AT THE SEVERAL STATIONS BETWEEN SANTIAGO AND MONTEVIDEO.

From Santiago de Chile to Mendoza and back by the Uspallata Pass.

Place.	South latitude.	West longitude.	Elevation above sea-level.	East declination.	Inclination.	Horizontal force. X.	Mag. mom't of magnet. *m*.	Total force.
	° ′ ″	° ′ ″	*Feet.*	° ′ ″	° ′ ″			
Santiago	33 26 25	70 38 24	1,793	16 27 29	35 36 40	6.451385	0.42105	7.93540
Posada de Chacabuco			2,173					
Cuesta de Chacabuco			4,225					
Santa Rosa de los Andes	32 48 14	70 40 09	2,564					
Chacra de Montumas	32 46 17	70 40 33	2,581	16 22 14	35 10 30	6.49090	0.42375	7.94094
Do do			2,649					
Mouth of Rio Colorado			3,454					
Estero de las Cruces	32 55 43	70 24 43	4,388	15 55 54	34 54 30	6.47505	0.42255	7.89574
Do do			4,426					
Rio del Peñon			6,608					
Alto de la Laguna	32 50 56	70 12 39	9,207	15 43 17	34 51 00	6.44369	0.42447	7.85192
Do do			9,267					
Casucha de la Cumbre	32 49 06	70 09 45	12,135	15 39 27	34 52 30	6.41623	0.42666	7.82243
Cumbre Pass, North Road			12,656					
Cumbre Pass, South Road			12,488					
Casucha de los Puquios	32 50 29	69 57 51	8,869	15 14 24	34 44 00	6.42626	0.42605	7.81960
Do do			8,961					
Punta de las Vacas	32 53 00	69 50 51	7,979					
Tupungato, (Peak)	33 21 40	69 50 43	22,450					
Uspallata	32 34 24	69 27 19	6,426	15 06 26	34 05 30	6.40651	0.42363	7.73538
Do			6,350					
El Paramillo			9,395					
Villavicensio	32 29 37	69 05 01	5,501					
Do			5,567					
Mendoza	32 51 15	68 57 15	2,497	15 05 02	34 22 42	6.40731	0.41970	7.76337
Do			2,469					

From Mendoza to Santiago and back by the Portillo Pass.

Rio de Mendoza			2,948					
La Arboleda			3,778					
La Guardia			6,677					
Los Arenales			8,193					
Foot of steep ascent of Eastern Portillo, east side.			13,331					
Eastern Portillo Pass			14,311					
Do do			14,319					
La Olla			10,350					
Valley of the Tunuyan			9,521					
Do do			9,442					
Western Portillo Pass			13,189					
Do do			13,475					
Foot of steep part of descent, west side			11,184					
San José de Chile			3,176					

From Mendoza to Montevideo and back across the Pampa.

Place.	South latitude.	West longitude.	Elevation above sea-level.	East declination.	Inclination.	Horizontal force. X.	Mag. mom't of magnet. *m*.	Total force.
	° ′ ″	° ′ ″	*Feet.*	° ′ ″	° ′ ″			
Los Barriales			1,954					
Aeoroeorto	33 25 36	67 41 44	1,726	14 55 48	34 26 30	6.37344	0.42019	7.72818
El Desaguadero			1,648					
El Balde			1,565					
San Luis de la Punta	33 16 57	66 27 13	2,548	14 39 45	33 24 30	6.36979	0.42085	7.63060
Rio Quinto			2,434					
San José del Morro			3,193					
Villa de la Conecpcion	33 06 37	64 22 46	1,532	13 29 22	32 38 30	6.31460	0.42121	7.49900
El Tortoral			798					
Esquina de Medrano			509					
Fraile Muerto	32 36 24	62 38 37	305?					
Peje Tree Station	32 58 00	62 32 09		13 00 00	31 50 30	6.28374	0.41860	7.39690
Saladillo de Rui Diaz	32 56 09	62 18 49	541?					
Cabeza del Tigre			339?					
Los Desmochados			477?					
Saladillo de la Horqueta			261?					
El Rosario	32 56 15	60 32 19	*234	12 01 13	30 57 00	6.23680	0.41971	7.27225
Buenos Ayres	34 35 30	58 22 00		11 45 17	32 11 30	6.19705	0.41814	7.32278
Montevideo	34 53 18	56 13 30		10 12 41	32 07 30	6.15906	0.41616	7.27255

* Above Buenos Ayres.

METEOROLOGICAL OBSERVATIONS MADE BETWEEN SANTIAGO AND BUENOS AYRES.

Place.	Year, day and month.	Hour.	Syphon barometer.	Aneroid barometer.	Attached thermometer.	Wet bulb thermometer.	Dry-bulb thermometer.	Sky.	Winds.		Remarks.
									Direction.	Force	
			Inches.	*Inches.*	°	°	°				
Santiago	Nov. 14, 1852	M.	28.324	31.252	65			Clear			
Do	Nov. 15, 1852	8 A. M.	.316	.270	63.5			Clear			Set out at 9.30 A. M.
San Ignacio	Nov. 15, 1852	11 A. M.		.525			86	Clear			
Posada de Colina	Nov. 15, 1852	3 P. M.		.125			86	Clear			Broke the aneroid.
Posada de Chacabuco	Nov. 15, 1852	8 P. M.	27.753		59			Clear			
Cuesta de Chacabuco	Nov. 16, 1852	7 A. M.	25.843		68			Clear			
Chacra de Montumas	Nov. 16, 1852	M.	27.170		72.5	60	73	Clear			
Do do	Nov. 16, 1852	3 P. M.	.357		73	60.5	77	Clear			
Do do	Nov. 16, 1852	9 P. M.	.403		56.3	51.5	57	Clear			
Do do	Nov. 17, 1852	6 A. M.	.462		53.6	51	55	Clear			
Do do	Nov. 17, 1852	9 A. M.	.477		62.6	55	64	Clear			
Do do	Nov. 17, 1852	M.	.458		70.2	55.5	70.5	Clear			
Do do	Nov. 17, 1852	3 P. M.	.466		71.6	56.7	72.3	Clear			
Do do	Nov. 17, 1852	6 P. M.	.454		63	55.5	67.5	Clear			
Do do	Nov. 18, 1852	6 A. M.	.434		49	45.5	49	Clear			
Santa Rosa	Nov. 18, 1852	9 A. M.	.387		64.4	54.3	64	Clear			
Chacra de Montumas	Nov. 18, 1852	M.	.450		74.7	61.5	75	Clear			
Do do	Nov. 18, 1852	4 P. M.	.410		73.4	57.5	73	Clear			
Do do	Dec. 31, 1853	M.	27.364	29.937	82	64	83	Clear	Southwestward.	3	Different instrum'ts.
Mouth of Rio Colorado	Nov. 19, 1852	M.	26.564		70.7			Clear			
Do do	Nov. 19, 1852	2 P. M.	.509		82.4			Clear			
Estero de las Cruces	Nov. 19, 1852	6 P. M.	25.710		69.3	51	70	Clear			
Do do	Nov. 20, 1852	5 A. M.	.658		48.2	42	47.5	Clear			
Do do	Nov. 20, 1852	8 A. M.	.698		63.8	50.2	64.5	Clear			
Do do	Nov. 20, 1852	9 A. M.	.694		70.7	53.5	71	Clear			
Do do	Nov. 20, 1852	1 P. M.	.658		75.2	50.5	75.5	Clear			
Do do	Dec. 30, 1853	M.	.708	28,100	78	55.5	78.5	Clear	Westward	4	
Rio del Peñon	Nov. 20, 1852	7 P. M.	24.044		61.2			Clear			
Do	Nov. 21, 1852	5 A. M.	.017		51.8	36	52.5	Clear			
Alto de la Laguna	Nov. 21, 1852	M.	21.591		62.6	40	60	K. 3	Southwestward.	5	

METEOROLOGICAL OBSERVATIONS—Continued.

Place.	Year, day and month.	Hour.	Syphon barometer.	Aneroid barometer.	Attached thermometer.	Wet-bulb thermometer.	Dry-bulb thermometer.	Sky.	Winds.		Remarks.
									Direction.	Force	
			Inches	*Inches.*	°	°	°				
Alto de la Laguna . .	Nov. 21, 1852	3 P. M.	21.552		57.7	43.5	58	K. 3 . . .	Southwestward.	5	
Do do .	Nov. 21, 1852	6 P. M.	.568		48.7	38	48	K. 2 . . .	Southwest ward.	1	Snow on hills tinged rose-color from the rays of setting sun.
Do do .	Nov. 22, 1852	6 A. M.	.524		40	30	41.2	Clear . . .		0	
Do do .	Dec. 29, 1853	2 P. M.	.632	23.687	64	45	68	Clear . . .	Southwestward.	5	
Casucha de la Cumbre	Nov. 22, 1852	M.	19.312		40	28.3	37.5	Clear . . .	Southwestward.	5	
Do do .	Nov. 22, 1852	3 P. M.	.280		41.9	30.5	41.7	Clear . . .	Southwestward.	5	
Do do .	Nov. 22, 1852	6 P. M.	.284		40.6	30.7	40	Clear . . .	Southwestward.	1	
Do do .	Nov. 23, 1852	6 A. M.	.308		38.8	23.5	36.5	Clear . . .		0	
Do do .	Nov. 23, 1852	9 A. M.	.304		55.4	32	47.5	Clear . . .	Southwestward.	3	Barometer in the sun.
Cumbre S. road . . .	Nov. 23, 1852	9.30 A. M.	.162		50.9			Clear . . .	Southwestward.	6	
Cumbre N. road . .	Dec. 29, 1853	M.	19.114	21.262	59	39	58	Clear . . .	Westward	6	
Casucha de los Puquios	Nov. 23, 1852	3 P. M.	21.966		71.4	45.3	68.5	Clear . . .	Southwestward.	5	
Do do .	Nov. 23, 1852	6 P. M.	.954		62.6	43	63	Clear . . .	Southwestward.	2	
Do do .	Nov. 24, 1852	6 A. M.	.903		51.8	31.5	47.5	Clear . . .		0	
Do do .	Nov. 24, 1852	9 A. M.	.867		64.4	43.5	65	Clear . . .	Southwestward.	3	
Do do .	Nov. 24, 1852	M.	.839		68.0	44.0	68.8	Clear . . .	Southwestward.	5	
Do do .	Dec. 28, 1853	6 P. M.	.880	24.137	68.0	45	69	Clear . . .	Westward	5	
Punta de las Vacas .	Dec. 28, 1853	9.30 A. M.	22.658		75	50	68	Clear . . .	Eastward .	2	
Uspallata	Nov. 26, 1852	6 A. M.	23.859		51	48	51	K. to eastw'd	Eastward .	3	
Do do .	Nov. 26, 1852	9 A. M.	.816		60.8	50	62.5	K. to eastw'd	Eastward .	4	
Do do .	Nov. 26, 1852	M.	.835		64	51.7	65.7	K. to eastw'd	Eastward .	4	
Do do .	Nov. 26, 1852	3 P. M.	.855		63	51	64.5	K. to eastw'd	Eastward .	4	
Do do .	Nov. 26, 1852	9 P. M.	.902		55.4	45.7	55.5				
Do do .	Dec. 26, 1853	M.	24.016	26.400	72	58	75	K. to eastw'd	Eastward	2	
El Paramillo . . .	Dec. 25, 1853	5 P. M.	21.576		79			Clear . . .			
Villavicensio . .	Nov. 27, 1852	3 P. M.	24.615		52.3	44	51	K. S. 1 . .		0	
Do.	Dec. 25, 1853	11 A. M.	24.690		76	57	75	Clear . . .	Eastward .	3	
Mendoza	Nov. 28, 1852	6 A. M.	27.584		60.8	53.5	64	Clear . . .			Observations in Mendoza all made in a draught of air in a room of hotel.
Do.	Nov. 30, 1852	9 A. M.	.568		71.6	62.5	72.7	Clear . . .			
Do.	Nov. 30, 1852	M.	.540		75.2	63.8	75.5	Clear . . .			
Do.	Nov. 30, 1852	3 P. M.	.495		76	63.5	77.5	Clear . . .			
Do.	Dec. 1, 1852	Midnight. .	.560		72	61.5	72.5	Clear . . .			
Do.	Dec. 1, 1852	9 A. M.	.678		67	55	69	Clear . . .			
Do.	Dec. 1, 1852	M.	.694		71.6	60.5	73.2	C. K. S. 8 .	Northeastward.	3	
Do.	Dec. 1, 1852	3 P. M.	.631		73.4	62	75	C. K. 5 . .	Eastward .	2	
Do.	Dec. 1, 1852	7 P. M.	.587		73	63	74	C. K. 4 . .	Calm . .		
Do.	Dec. 2, 1852	9 A. M.	27.627		73.4	62.5	73.3	Clear . . .	Northeastward.	2	
Do.	Dec. 2, 1852	M.	.525		76	64	76.5	Clear . . .	Northeastward.	3	
Do.	Dec. 2, 1852	3 P. M.	.501		79	65	79	K. S. 2 . .	Northeastward.	2	
Do.	Dec. 3, 1852	9 A. M.	.690		73.4	64	75	K. S. 1 . .	Southward	4	
Do.	Dec. 3, 1852	M.	.670		75.2	66	77.5	K. S. on mts.	Northeastward.	4	
Do.	Dec. 3, 1852	4 P. M.	.560		79	66.2	79.2	K. S. 2 . .	Northeastward.	2	
Do.	Dec. 4, 1852	10 A. M.	.477		78.8	67.7	78.5	Clear . . .	Northeastward.	1	
Do.	Dec. 5, 1852	M.	.458		81	66.8	81	K. 2 . . .	Northeastward.	2	
Do.	Dec. 5, 1852	3 P. M.	.280		82.4	68.5	83	K. S. on mts.	East-northeast.	3	Temperature in sun, wet, 73°; dry, 100°.

METEOROLOGICAL OBSERVATIONS—Continued.

Place.	Year, day and month.	Hour.	Syphon barometer.	Aneroid barometer.	Attached thermometer.	Wet-bulb thermometer.	Dry-bulb thermometer.	Sky.	Winds.		Remarks.
									Direction.	Force.	
			Inches.	*Inches.*	°	°	°				
Mendoza	Dec. 6, 1852	9 A. M.	27.237		78.8	70.5	80				A storm brewing.
Do	Dec. 6, 1852	M.	.178		84.2	69.3	82.7				A storm brewing.
Do	Dec. 6, 1852	6 P. M.	.245		81						A squall of wind and rain from the southward.
Do	Dec. 6, 1852	10 P. M.	.497		76						Raining.
Do	Dec. 7, 1852	5 A. M.	.634		68						Cloudy.
Do	Nov. 27, 1853	9 A. M.	.560	27.325	80	71	82.5	C. K. 3	Northeastward.	2	Different instruments.
Do	Nov. 27, 1853	M.	.492	.275	81	70	80.5	K. 3	Northeastward.	2	
Do	Nov. 27, 1853	3 P. M.	.374	.175	82	71.5	82.5				
Do	Nov. 28, 1853	9 A. M.	.638	.362	79.5	69.5	79	K. S. 7	Southward	3	
Do	Nov. 28, 1853	M.	.560	.337	81.5	69.5	81.5	K. 9	Southeastward.	3	At 2 P. M. a light shower of rain.
Do	Nov. 28, 1853	3 P. M.	.532	.325	80.5	70	81.5	K. S. 6	Southeastward.	3	
Do	Nov. 29, 1853	9 A. M.	.610	.395	80	71	80	K. 2	Eastward	1	
Do	Nov. 29, 1853	M.	.540	.325	81	70.5	82.5	K. S. 7	Eastward	2	
Do	Nov. 29, 1853	3 P. M.	.420	.225	80.5	70	82	K. S. 1	Northeastward.	2	
Do	Nov. 30, 1853	9 A. M.	.380	.170	79	68.5	80	Clear		0	
Do	Nov. 30, 1853	M.	.346	.150	81	68.5	77.5	Clear	Northeastward.	2	
Do	Nov. 30, 1853	3 P. M.						Clear		0	Occupied with eclipse.
Do	Dec. 1, 1853	9 A. M.	.700	475	77.5	64	78	Clear	Eastward	3	
Do	Dec. 1, 1853	M.	.670	.437	79	62	79	Clear	Northeastward.	2	
Do	Dec. 1, 1853	3 P. M.	.600	.375	79	63.5	80.5	Clear	Northeastward.	2	
Do	Dec. 2, 1853	9 A. M.	.648	.425	78	62.5	78.0	Clear		0	
Do	Dec. 2, 1853	M.	.592	.370	79	63	79	C. 1	Northeastward.	2	
Do	Dec. 2, 1853	3 P. M.	.492	.275	80	63.5	81	C. 2	North-northeastward.	2	
Do	Dec. 3, 1853	9 A. M.	.602	.375	79	65.5	78.3	K. S. 6	Southeastward.	3	
Do	Dec. 3, 1853	M.	.544	.325	82	64.5	80	K. S. 9	Southeastward.	2	
Do	Dec. 3, 1853	3 P. M.	.454	.237	80	64.5	80	K. S. 2	Eastward	1	
Do	Dec. 4, 1853	9 A. M.	.576	.337	74.3	60.5	75.5	Clear	Eastward	3	
Do	Dec. 4, 1853	M.	.556	.325	80	60.5	77	Clear	Eastward	2	
Do	Dec. 4, 1853	3 P. M.	.512	.300	78.5	63.5	79.3	Clear	Eastward	2	
Do	Dec. 5, 1853	9 A. M.	.630	.400	76.5	61	77	Clear		0	
Do	Dec. 5, 1853	M.	.526	.300	79.2	60	78.7	Clear	Southeastward.	3	
Do	Dec. 5, 1853	6 P. M.	.386	.170	79	61	78.5	Clear	Eastward	2	
Do	Dec. 6, 1853	M.	.424	.200	80.5	65.5	80.5	Clear	Eastward	2	
Do	Dec. 21, 1853	9 A. M.	.460		79	65.5	79				
Do	Dec. 23, 1853	1 P. M.	.550	30.375	77.5	60.5	79	Clear	Northeastward.	2	Altered one of the springs of ancroid for greater rauge.
Rio de Mendoza	Dec. 7, 1853	7 A. M.		26.800				Clear			
Raucheria called La Arboleda.	Dec. 8, 1853	M.	26.262	26.160	71			K. S. 10			Snowing in the mountains.
La Guardia	Dec. 9, 1853	10 A. M.	23.768	24.120	80	53.5	67.5	Clear	Eastward	3	
Los Arenales	Dec. 9, 1853	M.	22.530	23.000	75	45	57	K. 5	Eastward	4	
Foot of E. Portillo, (E. side.)	Dec. 10, 1853	8 A. M.	18.534	21.737	56	36	42.5	Clear	Northeastward.	2	
Eastern Portillo	Dec. 10, 1853	10 A. M.	17.814	Don't work.	60	26.5	33	K. 1	Westward	3	
Do	Dec. 18, 1853	9 A. M.	17.774		30		27				Snowing and wind blowing in squalls.
La Olla	Dec. 17, 1853	6 P. M.	20.586		39		39				Snowing; wind light and variable.
Valley of the Tunuyan	Dec. 10, 1853	4 P. M.	21.448		68	44.5	66.5	Clear	Westward	5	
Do do	Dec. 17, 1853	2 P. M.	21.396		54		54	K. S. 1	South-southeastward.	6	
Base of W. Portillo, (E. side.)	Dec. 11, 1853	5 A. M.				24	29.5	Clear		9	

METEOROLOGICAL OBSERVATIONS—Continued.

Place.	Year, day and month.	Hour.	Syphon barometer.	Aneroid barometer.	Attached thermometer.	Wet-bulb thermometer.	Dry-bulb thermometer.	Sky.	Winds.		Remarks.
									Direction.	Force.	
			Inches.	*Inches.*	°	°	°				
Western Portillo . .	Dec. 11, 1853	9 A. M.	18.616		68	32	45	Clear . . .	Westward	3	
Do	Dec. 17, 1853	10 A. M.	.400		46	32	40	Clear . . .	Northwestward.	5	Cloudy over E. Portillo.
Foot of W. Portillo, (W. side.)	Dec. 11, 1853	10 A. M.	20.166		63						At foot of steep part of descent.
San José de Chile.....	Dec. 15, 1853	3 P. M.	26.864		81	61	81	Clear . . .		0	Broke the wet and dry thermometers.
Los Barriales . . .	Dec. 7, 1852	M.	28.016		68.4			K. S. 10 . .			
Do	Dec. 8, 1852	6 A. M.	27.965		60.8			N. S. 10 . .			Light rain, occasionally.
En Camino	Dec. 8, 1852	9 A. M.									Broke my barometer.
Acoroeorto	Dec. 10, 1852	7 A. M.				58	64	Clear . . .	Northward	2	
Do	Dec. 10, 1852	M.					82	Clear . . .	Northward	3	
Do	Nov. 24, 1853	9 A. M.	28.230		85	72	84.5	Clear . . .		0	Different instruments.
Do	Nov. 24, 1853	M.	.168	27.950	87.3	72	92.5	K. 1 . . .		0	
Do	Nov. 24, 1853	3 P. M.	.106		92.5	70.3	94.5	K. S. 9 . .	Eastward .	2	Appearances of a storm.
La Represa	Dec. 12, 1852	2 P. M.				66.5	93	Clear . . .			In the shade & draught.
Do	Dec. 12, 1852	2 P. M.				70	100.1	Clear . . .			In the sun & draught.
El Desaguadero . .	Nov. 23, 1853	M.	.358		86	69	85.5	Clear . . .	Southeastward.	2	In the sun: wet, 72°; dry, 97°.
El Balde	Nov. 22, 1853	11 A. M.	.524		96		88	Clear . . .	West-northwestward.	2	
Do	Nov. 22, 1853	3 P. M.	.380		89		89	K. 2 . . .	Southwestward.	2	
San Luis de la Punta .	Dec. 13, 1852	9 A. M.				64.5	83				
Do	Dec. 13, 1852	3 P. M.				66	85				
Do	Dec. 13, 1852	6 P. M.				66	82				
Do	Dec. 14, 1852	6 A. M.				54.5	66.5				
Do	Dec. 14, 1852	9 A. M.				57	78				
Do	Dec. 14, 1852	M.									
Do	Dec. 14, 1852	3 P. M.				63.5	84				
Do	Dec. 15, 1852	6 A. M.				62.5	73	C. K. S. 8 .			Rained during night.
Do	Dec. 15, 1852	9 A. M.				64.5	76	C. K. 2 . .	Northeastward.	5	
Do	Dec. 15, 1852	M.				64	82	0 . . .	Northeastward.	6	
Do	Dec. 15, 1852	3 P. M.				63.5	79.5	0 . . .	Northeastward.	4	
Do	Dec. 16, 1852	6 A. M.				68	74	K. 8 . . .	Northeastward.	1	
Do	Dec. 16, 1852	9 A. M.				70.5	73	K. 10 . . .	Northeastward.	3	
Do	Dec. 16, 1852	M.				67.5	72.5	Raining . .	Northeastward.	2	
Do	Dec. 17, 1852	6 A. M.				64	67	Heavy rain .	Southwestward.	5	Thunder & lightning.
Do	Dec. 17, 1852	9 A. M.				58	62	Heavy rain .	Southwestward.	8	Do do.
Do	Dec. 17, 1852	M.				56.5	60.5	Light rain .	Southward	6	This blow was felt for two or three days at Buenos Ayres; strongest at M. of 18th.
Do	Dec. 17, 1852	3 P. M.				55.5	62.3	K. S. 1 . .	Southward	6	
Do	Dec. 17, 1852	6 P. M.				54.5	61.5	K. S. 9 . .	South-southwestward.	7	
Do	Dec. 18, 1852										At work.
Do	Dec. 19, 1852	6 A. M.				53.5	62.5	Clear . . .		0	
Do	Dec. 19, 1852	9 A. M.				58.5	70.5	Clear . . .	North-northwestward.	3	In the sun: wet, 64°; dry, 74°.
Do	Dec. 19, 1852	M.				65.5	73.5	Clear . . .	North-northwestward.	2	In the sun: wet, 66°; dry, 84°.5.
Do	Nov. 21, 1853	9 A. M.	27.496		76.5	62	73	Clear . . .	Northwestward.	2	
Do	Nov. 21, 1853	M.	.484		80	64	75	Clear . . .	Northwestward.	2	Adjusted aneroid.
Do	Nov. 21, 1853	3 P. M.	.384	27.150	82.3	60.5	86	Clear . . .	Northwestward.	1	
Do	Nov. 21, 1853	6 P. M.				67	95	Clear . . .			In the sun.
Rio Quinto	Nov. 20, 1853	2 P. M.	.576		83		83	Clear . . .	Eastward .	2	
San José del Morro .	Nov. 19, 1853	2 P. M.	26.796		65		65?	Clear . . .		0	
Do	Nov. 19, 1853	6 P. M.	.770		59		59?	Clear . . .		0	

METEOROLOGICAL OBSERVATIONS—Continued.

Place.	Year, day and month.	Hour.	Syphon barometer.	Aneroid barometer.	Attached thermometer	Wet-bulb thermometer.	Dry-bulb thermometer.	Sky.	Winds.		Remarks.
									Direction.	Force.	
			Inches.	*Inches.*	°	°	°				
San José del Morro .	Nov. 20, 1853	6 A. M.	26.754		56		56?	Clear . . .		0	
Villa de la Conception	Dec. 24, 1852	7 A. M.				57	61.5	K. S. 10 . .	Southward	5	
Do	Dec. 24, 1852	8 A. M.				56	64.5	K. 2 . . .	South-south eastward.	5	
Do	Dec. 24, 1852	9 A. M.				55.5	67	C. K. 1 . .	South-south eastward.	5	
Do	Dec. 24, 1852	11 A. M.				56	71.2	Clear . . .	Southeast-ward.	4	
Do	Dec. 24, 1852	M.				55.8	71.2	Clear . . .	Southeast-ward.	4	
Do	Dec. 24, 1852	1 P. M.				56.5	73	Clear . . .	Southeast-ward.	4	
Do	Dec. 24, 1854	3 P. M.				56.5	73	Clear . . .	Southeast-ward.	3	
Do	Dec. 24, 1852	4 P. M.				57	73.5	C. 1 . . .	Southeast-ward.	3	
Do	Dec. 24, 1852	5 P. M.				56	72.5	C. S. 1 . .	Southeast-ward.	3	
Do	Dec. 24, 1852	6 P. M.				57.5	65	Clear . . .	Southeast-ward.	1	
Do	Dec. 25, 1852	9 A. M.				58.5	71	C. K. 8 . .	North-north-eastward.	3	
Do	Dec. 25, 1852	M.				63	77.3	C. K. 2 . .	Northward	2	
Do	Dec. 25, 1852	3 P. M.				63	77.5	Clear . . .	Northward	2	
Do	Dec. 25, 1852	6 P. M.				63	75.5	Clear . . .	Northward	2	
Do	Nov. 16, 1853	9 A. M.	28.260		74	67.5	73.5	C. S 10 . .	Eastward .	2	
Do	Nov. 16, 1853	M.	.296	28.255	76	71	74.5	C. K. 9 . .	Southeast-ward.	3	
Do	Nov. 16, 1853	3 P. M.	.258		77	69	76.5	C. K. 5 . .	Southeast-ward.	3	
Do	Nov. 17, 1853	M.	.552		56.5		56.5	Raining . .	Southeast-ward.	4	
Bank of Rio Cuarto .	Dec. 26, 1852	M.				66	86	Clear . . .	Northeast-ward.	4	
Near a laguna on the Pampa.	Dec. 27, 1852	1 P. M.				71.5	91.5	K. S. 2 . .	Northeast-ward.	3	
Do	Dec. 27, 1852	2 P. M.				72	92	K. S. 3 . .	Northeast-ward.	3	
Do	Dec. 27, 1852	2 P. M.				74	94				In the sun.
El Tortoral	Nov. 14, 1853	M.	29.216		85.5	65	85	C. 2 . . .	Eastward .	3	
Do	Nov. 14, 1853	M.				66	92				In the sun.
Esquina de Medrano .	Nov. 13, 1853	M.	29.488		84.5	65.5	83.5	Clear . . .	Northward	4	
Fraile Muerto . . .	Nov. 12, 1853	9 A. M.	29.704		71.5	59	73	Clear . . .	Southward	2	
Do	Nov. 12, 1853	12 M.	27.710	29.590	76	61.5	77	Clear . . .	Southward	2	
Do	Nov. 12, 1853	3 P. M.	27.642	29.605	80	65.5	80.5	Clear . . .	Southward	3	
Los Torsales . . .	Dec. 28, 1852	3 P. M.				63.5	84.5	Clear . . .	Northeast-ward.	3	
Pejc Tree Station .	Dec. 29, 1852	11 A. M.				67.5	80.0	Clear . . .	Northward	3	
Do do .	Dec. 29, 1852	M.				67.5	81	Clear . . .	Northward	3	
Do do .	Dec. 29, 1852	1 P. M.				67	81	Clear . . .	Northward	3	
Do do .	Dec. 29, 1852	2 P. M.				68	83	Clear . . .	Northward	3	
Do do .	Dec. 29, 1852	3 P. M.				67.5	84	Clear . . .	Northward	3	
Do do .	Dec. 29, 1852	5 P. M.				68	86	Clear . . .	Northward	2	
Do do .	Dec. 29, 1852	6.30 P. M.				67	77.5	Clear . . .	Northward	1	
Saladillo de Rui Diaz .	Nov. 10, 1853	M.	29.488		81		81				
Do do .	Nov. 10, 1853	6 P. M.	.404	29.325	77		81	C. K. 3 . .	Northward	2	
Do do .	Dec. 30, 1852	5 A. M.				55.5	56	Clear . . .		0	Heavy dew.
Cabeza del Tigre . .	Dec. 30, 1852	2 P. M.				71	93	Clear . . .	East-south-eastward.		
Do do .	Nov. 9, 1853	6 P. M.	.646		71		71	C. K. 9 . .	Westward	1	
Do do .	Nov. 10, 1853	6 A. M.	.622		58		58	K. S. 9 . .	Northward	1	
La Cruz Alta . . .	Nov. 9, 1853	M.	.808		74		74	C. S. 1 . .	Westward	2	
Guardia de la Esquina	Nov. 9, 1853	10 A. M.	30.330		68		68?	C. K. 2 . .	Westward	3	
Arequitas	Nov. 9, 1853	6 A. M.	29.748		62		62	K. 2 . . .		0	
Los Desmochados . .	Nov. 8, 1853	M.	.598		64		64	Raining . .	Eastward .		
Saladillo de la Orqueta	Nov. 8, 1853	6 A. M.	708		64		64				
El Rosario	Jan. 3, 1853	6 A. M.				67	69	Clear . . .			
Do	Jan. 3, 1853	9 A. M.				75	82	C. 6 . . .	Northward	4	

METEOROLOGICAL OBSERVATIONS—Continued.

Place.	Year, day and month.	Hour.	Syphon barometer.	Aneroid barometer.	Attached thermometer.	Wet-bulb thermometer.	Dry-bulb thermometer.	Sky.	Winds.		Remarks.
									Direction.	Force	
			Inches.	*Inches.*	°	°	°				
El Rosario	Jan. 3, 1853	M.				75	87	C. 3 . . .	Northward	4	
Do	Jan. 3, 1853	3 P. M.				75	86	C. 3 . . .	Northward	3	
Do	Jan. 3, 1853	6 P. M.				74.5	84	C. 8 . . .	Northeastward.	1	
Do	Jan. 3, 1853	11 P. M.				77	80	Clear . . .		0	
Do	Jan. 4, 1853	6 A. M.				69.2	75.5	C. S. 1 . .	Northeastward.	5	
Do	Jan. 4, 1853	9 A. M.				72	80.7	K. 9 . . .	Northeastward	5	
Do	Jan. 4, 1853	M.				75	85	K. S. 8 . .	Northeastward.	4	
Do	Jan. 4, 1853	1 P. M.				74.5	82	C. S. 1 . .		0	
Do	Jan. 4, 1853	1.30 P. M.									
Do	Jan. 4, 1853	5 P. M.				69	73	Nimbus 10 .	Southeastward.	6	A violent squall of wind and rain with thunder and lightning, during which a house near by was struck.
Do	Jan. 4, 1853	9 P. M.				71	75	N. S. 10 . .		0	
Do	Jan. 4, 1853	11 P. M.				68.5	72	S. 10 . . .		0	
Do	Oct. 29, 1853	9 A. M.	29.988	29.848	77	69.5	76.3	K. S. 10 . .	Eastward .	2	
Do	Oct. 29, 1853	M.	.996	.855	80.5	72	75	K. 2 . . .	Eastward .	1	
Do	Oct. 29, 1853	3 P. M.	.954	.837	82	73.5	80	K. S. 7 . .	Eastward .	3	
Do	Oct. 30, 1853	9 A. M.	.954	.850	72	69	71	N. 10 . . .	Southeastward.	6	Raining during the night. Heavy thunder and lightning.
Do	Oct. 30, 1853	M.	.934	.805	70	67.7	70	N. 10 . . .	East-southeastward.	6	Rain occasionally.
Do	Oct. 30, 1853	3 P. M.	.948	.800	69	67.5	68	N. 10 . . .	Eastward .	6	Heavy rain.
Do	Oct. 31, 1853	9 A. M.	30.088	.945	66	62	66.5	S. 10 . . .	Northeastward.	3	
Do	Oct. 31, 1853	M.	.028	.900	66	63.5	67	S. 10 . . .	Eastward .	3	Water boils at 100°.1 centig.
Do	Oct. 31, 1853	3 P. M.	.000	.870	66.7	64.3	67.5	S. 10 . . .	Eastward .	3	
Do	Nov. 1, 1853	9 A. M.	29.868	.748	65.5	64.5	65	N. 10 . . .	North-northeastward.	2	Rain, thunder and lightning.
Do	Nov. 1, 1853	M.	.800	.680	68	66	67.5	K. S. 10 . .	Northward	2	
Do	Nov. 1, 1853	3 P. M.	.766	.655	69.3	67	69	S. 10 . . .	Northward	2	Appearances of rain.
Do	Nov. 1, 1853	4 P. M.						N. 10 . . .	Southeast-eastward.	2	Raining.
Do	Nov. 2, 1853	9 A. M.	.966	.830	72	68	71	K. 2 . . .	Southward	3	
Do	Nov. 2, 1853	M.	.976	.840	74	68.5	74	Clear . . .	Southeastward.	3	
Do	Nov. 2, 1853	3 P. M.	.984	.845	75.7	67	76.5	K. 2 . . .	Southward	1	
Do	Nov. 3, 1853	9 A. M.	39.108	.970	75	68	74	Clear . . .	Southeastward.	2	
Do	Nov. 3, 1853	M.	.082	.937	78.5	68	76	Clear . . .		0	
Do	Nov. 3, 1853	3 P. M.	.022	.880	79.3	67	77	Clear . . .	Northward	2	
Do	Nov. 4, 1853	9 A. M.	.004	.875	77.7	69.5	78.5	C. S. 1 . .	North-northeastward.	3	Air feels dry and disagreeable.
Do	Nov. 4, 1853	M.	29.956	.825	80	70.3	80	Clear . . .	Northward	3	Air feels dry and disagreeable.
Do	Nov. 4, 1853	3 P. M.	.840	.730	81	70	80.5	Clear . . .	Northward	2	
Do	Nov. 5, 1853	9 A. M.	.756	.637	82.3	73	83	K. 2 . . .	Northwestward.	3	Atmosphere smoky.
Do	Nov. 5, 1853	M.	.712	.595	87	78.5	88	K. 2 . . .	North-northwestward.	3	Atmosphere smoky.
Do	Nov. 5, 1853	3 P. M.	.678	.570	88.5	79.5	89.5	K. 1 . . .	North-northwestward.	3	Atmosphere smoky.
Do	Nov. 6, 1852	9 A. M.	.898	.775	70	68	70.5	N. S. 10 . .	South-southeastward.	3	
Do	Nov. 6, 1853	M.	.898	.775	75.5	72	75	K. S. 9 . .	Southward	2	
Do	Nov. 6, 1853	3 P. M.	.846	.725	75.3	72.5	75	N. S. 1.0 . .	Southward	2	Raining.
Do	Nov. 7, 1853	M.	.750		74	73	73.5	N. 10 . . .	Northward	1	Scotch mist.
Buenos Ayres . . .	Jan. 16, 1853	9 A. M.				60.7	67.3	Clear . . .			
Do	Jan. 16, 1853	M.				64	72	K. 2 . . .			
Do	Jan. 16, 1853	3 P. M.				64.5	72	K. 1 . . .			
Do	Jan. 17, 1853	M.				68.8	76	Clear . . .			
Do	Jan. 17, 1853	3 P. M.				68	77	Clear . . .			
Do	Jan. 17, 1853	10 & 11 P. M.									A hard squall of wind and rain, with thunder and lightning.

METEOROLOGICAL OBSERVATIONS—Continued.

Place.	Year, day and month.	Hour.	Syphon barometer.	Aneroid barometer.	Attached thermometer.	Wet-bulb thermometer.	Dry-bulb thermometer.	Sky.	Winds.		Remarks.
									Direction.	Force.	
			Inches.	*Inches.*	°	°	°				
Buenos Ayres . . .	Jan. 18, 1853	9 A. M.				65.5	69.3				
Do	Jan. 18, 1853	M.				67	71	C. K. S. 7 .	Southward	2	
Do	Jan. 18, 1853	3 P. M.				68	73	C. K. 6 . .	Southeastward.	4	
Do	Jan. 19, 1853	9 A. M.				72.5	78	Clear . . .			
Do	Jan. 20, 1853	6 A. M.				68	71	Clear . . .			
Do	Jan. 20, 1853	9 A. M.				72	77.5	Clear . . .			
Do	Jan. 20, 1853	M.				76	82	Clear . . .			
Do	Jan. 20, 1853	3 P. M.				75	84	Clear . . .			
Do	Jan. 20, 1853	6 P. M.				74	83	Clear . . .			
Do	Jan. 21, 1853	9 A. M.				73	82.5	C. K. 3 . .			
Do	Jan. 21, 1853	M.				74.5	83	C. K. S. 8 .			
Do	Jan. 21, 1853	3 P. M.				73.5	83	C. K. S. 10 .			
Do	Jan. 22, 1853	Midnight.				74	80	C. K. 6 . .			Heavy rain during the night.
Do	Jan. 22, 1853	9 A. M.				74.5	79	C. S. 6 . .			
Do	Jan. 22, 1853	M.				74.5	80.5	C. 5 . . .	Northwestward.	4	
Do	Jan. 22, 1853	1 P. M.				74.3	81.2	C. 2 . . .	Northwest ward.	4	
Do	Jan. 22, 1853	2 P. M.				75	82	C. 2 . . .	Northwestward.	4	
Do	Jan. 22, 1853	3 P. M.				75	83	C. 2 . . .	Northwestward.	3	
Do	Jan. 22, 1853	4 P. M.				75.5	83.7	C. K. S. 2 .	Northwestward.	3	
Do	Jan. 22, 1853	5 P. M.				73.8	82.3	C. K. S. 2 .	Northwestward.	3	
Do	Jan. 22, 1853	6 P. M.				73.5	81.5	Clear . . .	Northwestward.	3	
Do	Jan. 22, 1853	7 P. M.				74	80.5	Clear . . .	Northwestward.	2	
Do	Jan. 22, 1853	8 P. M.				75	80	Clear . . .		0	
Do	Jan. 22, 1853	9 P. M.				73	79	Clear . . .		0	
Do	Jan. 22, 1853	10 P. M.				70.5	78	Clear . . .		0	These observations were made in connexion with observations for change of declination, &c.
Do	Jan. 22, 1853	11 P. M.				69	77	Clear . . .			
Do	Jan. 23, 1853	Midnight.				68	76.3	Clear . . .			
Do	Jan. 23, 1853	1 A. M.				65.5	72	Clear . . .			
Do	Jan. 23, 1853	2 A. M.				64.5	71	Clear . . .			
Do	Jan. 23, 1853	3 A. M.				64.5	71	Clear . . .			
Do	Jan. 23, 1853	4 A. M.				64	70	Clear . . .			
Do	Jan. 23, 1853	5 A. M.				63	69.3	Clear . . .			
Do	Jan. 23, 1853	6 A. M.				63.5	69	Clear . . .			
Do	Jan. 23, 1853	7 A. M.				65	71	Clear . . .			
Do	Jan. 23, 1853	8 A. M.				67.5	73.5	Clear . . .			
Do	Jan. 23, 1853	9 A. M.				70	72.7	Clear . . .			
Do	Jan. 23, 1853	10 A. M.				70.7	75 5	Clear . . .			
Do	Jan. 23, 1853	11 A. M.				71.5	78.3	Clear . . .			
Do	Jan. 23, 1853	M.				71.8	78.5	Clear . . .			
Do	Jan. 23, 1853	3 P. M.				74.5	77.8	Clear . . .			
Do	Jan. 23, 1853	4 P. M.				71.0	77.5	Clear . . .			
Do	Jan. 23, 1853	7 P. M.				70	77	Clear . . .			
Do	Oct. 14, 1853	M.	30.174	30.075	71	63.3	70	K. 8 . . .	Northeastward.	4	
Do	Oct. 15, 1853	M.	.226	.125	69	64.5	68.5	K. S. 10 . .	Northeastward.	4	
Do	Oct. 16, 1853	M.	.054	29.955	67	64.5	67.5	K. S. 10 . .	Northeastward.	5	
Do	Oct. 17, 1853	M.		.900				K. S. 9 . .	Eastward .	4	
Do	Oct. 18, 1853										No observations; preparing to depart.
Do	Oct. 19, 1853	M.	.182	30.080	63	56.8	63.3	K. S. 8 . .	Southward	4	
Do	Oct. 20, 1853	M.	.060	29.975	63	56.5	64	K. 3 . . .	Eastward .	4	

SYMBOLS.—C, cirrus; K, cumuli; S, stratus; N, nimbus.—10, entirely clouded over.—Strength of wind: 0, calm; 1, light air; 10, strong gale.

Comparison with the standard barometer in Santiago.

December 14, 1853, 1 P. M.—Syphon, 28.264; standard, 28.268; attached thermometer, 79°; external, 73.4°.
January 3, 1854, M.—Syphon, 28.156; standard, 28.254; attached thermometer, 70°.
No attached thermometer to standard. In the calculation of elevations I have not taken into account this last comparison.

APPENDIX D.

REPORT

ON THE

MINERALS AND MINERAL WATERS OF CHILE:

BY

J. LAWRENCE SMITH,

PROFESSOR OF CHEMISTRY OF THE MEDICAL DEPARTMENT, UNIVERSITY OF LOUISVILLE.

REPORT ON THE MINERALS OF CHILE.

BY J. LAWRENCE SMITH,

PROFESSOR OF CHEMISTRY OF THE MEDICAL DEPARTMENT, UNIVERSITY OF LOUISVILLE.

The minerals collected by the United States naval astronomical expedition were almost exclusively those of silver and copper. The specimens of the ores of these two metals, taken in connexion with all authentic accounts, would lead one to believe that Chile hardly has a parallel in any region in the globe for the abundance as well as purity of these ores. Were it not for the physical difficulties connected with the surface of the country, and the scarcity of water and fuel, the wealth accruing to Chile from the working of these mines would be far greater than it is now.

Although the expedition furnishes no geological report of the country, it is thought proper, before describing the minerals in detail, to give some general idea of the geology of the country, more especially as connected with the minerals collected; and, for this purpose, recourse is had to the labors of M. Domeyko and M. L. Crosnier, as published in the "*Annales des Mines.*"

A general idea of the geological structure of Chile is readily formed, although we might be led to suppose otherwise from the great disturbing forces that have operated in that part of the world, in the form of injected masses of igneous rock, as well as from the present changes produced by existing volcanic action, and the gradual elevation of the whole country, with daily recurrence of earthquake action. These disturbing forces do not, however, in any way interfere with our study of the general geology of the country, while, of course, it renders the investigation of the geology of any particular region exceedingly embarrassing.

The great chain of the Andes extends parallel to the coast of Chile, at a distance of from 90 to 100 miles. On the eastern side it descends by gradual slopes towards the immense plains of the Argentine republic. On the western side, where the upheaving force appears to have concentrated all its energy, the slopes are abrupt, and transformed frequently into vertical precipices of considerable height. The mountains appear heaped confusedly one on top of the other, and the first impression is, that, in the midst of so much confusion, it is vain to seek for the primitive condition of the surface of Chile. Stratified rocks disappear entirely from north to south for the mean width of 45 miles—from the desert of Atacama to Valdivia. These rocks, although they once existed, are now profoundly altered or entirely melted by contact with the enormous masses of granite. The clay shales, which doubtless constituted the mass of the original stratified rocks, are now transformed into porphyries of every shade and of the most varied composition, alternating, in some parts, with beds of compact quartz. Even when the rocks are seen stratified, far removed from the masses of granite, and in beds sensibly horizontal or little inclined, still the numerous injected veins which traverse them, and ramify in all directions, prove that hardly anywhere have the rocks escaped the modifying force of igneous action.

Two immense granite elevations appear to have disturbed Chile in its entire length, parallel to the coast. One is immediately on the coast, with an average breadth of 45 miles, while the other is 100 miles east, in the midst of stratified rocks. The first range plunges into the sea, having valleys in various parts of it filled with tertiary deposits. As regards the respective ages of these two ranges, there appears to be a difference of opinion; some supposing that the range on the coast was first upheaved, and at a subsequent period the inner range, while others suppose them to have originated at the same time. But whichever one of these suppositions is true, the general characters of the rock of the two ranges are the same, as well as the metalliferous veins and accompanying vein rocks. Associated with the granite of these ranges, are hornblende rocks of the greatest variety, porphyries of all shades, containing crystals of feldspar, sometimes of considerable size. Besides these, there are other compact rocks, which cannot be properly classified.

The principal masses of secondary rocks that lay between the two ranges of mountains are composed of metamorphic porphyry, of a great variety of shades of color. Sometimes the porphyry is entirely altered; it then contains well-formed crystals of feldspar, and appears to have been melted where it now rests; and at other times it is earthy, as if the transformation has been incomplete. Large masses of reddish, yellow, and violet quartz, alternate with the porphyry, in certain points; also, calcareous beds, sometimes fossiliferous. These stratified rocks are elevated on the flanks of the Andes, and form some of the most prominent peaks of this range. These strata are so completely pierced and elevated in every direction by the masses of granite, as to modify in every possible manner their direction, inclination, and mineralogical character.

Besides the secondary stratified rocks just made mention of, there are other stratified rocks, which are horizontal, having been deposited since the elevation of the mountain chains. They are all, however, of recent origin and of small extent, disseminated along the coast, with the exception of the sandy plain that extends between Huasco and Copiapó, having a length of from 120 to 130 miles, with a variable width. This plain has, however, been elevated since its formation; in fact, M. Domeyko has determined three distinct terraces of successive and gentle elevation.

There are also alluvial deposits now going on in some of the valleys of the elevated portions of the mountains, consisting of a fine clay, transported there by the mountain streams.

According to the observation of M. Crosnier, he has encountered but one formation that appears to be of lacustrine origin, and this is situated in the cordilleras of Chillan, 45 miles north of Lavaderos.

The tertiary deposits subsequent to the elevation of the Andes contain, in many parts, lignite. Some of these places are worked. The principal mines are situated to the south of Biobio, some 20 miles distant from the mouth of this river, on the sea-shore. The mines are called Lota and Lotilla.

Some of the departments of Chile have been examined with minuteness by M. Domeyko, more especially that of Copiapó; which, although little else than a vast desert, is the richest department of Chile in mines of every description, there not being a single mountain where the veins are not of sufficient importance to be worked. And it is worthy of remark, that no mines are found higher than 4,500 feet above the level of the sea; and this peculiarity, I believe, pertains to all parts of Chile.

Taking the Bay of Copiapó as a starting point, and going east, we find the underlying rock of the country granite, the surface being covered with tertiary deposits of very modern origin, the same that is found at the mouth of all the Chilean rivers. These deposits form two and three terraces, and consist principally of sand, mixed with shell and gravel. At about six miles from the sea, solid calcareous beds show themselves, containing species of crustaceæ, now found living on the shore. The granite of this coast is fine grained, having the same aspect as that in the neighborhood of Coquimbo, and is the same as that of the mountains of Carrisal, San

Juan, and La Higuera, celebrated for their copper mines. Granite hills project frequently above the tertiary planes that extend to and rest on the first chain of granite rocks, which are low and rounded. It is in these rocks, wherever seen, whether on the coast or projecting above the tertiary planes, or, when still further east, projecting through secondary strata, that the copper and gold are found. A good example of this is the Cerro del Cobre mountain, which elevates itself at the bottom of the valley of Copiapó. This mountain is composed of an elevated mass of porphyritic diorite, traversed by veins of iron and copper ores, containing considerable quantities of magnetic iron and ferruginous oxide of copper, copper pyrites, &c. It forms a species of granitic island in the midst of stratified porphyritic and other compact rocks, more or less calcareous, and preserves all the characters of the coast rocks, even to the nature of the veins that it contains.

Further east, overlying the granite and dioritic rocks, are stratified porphyries; and here, at a height of 2,250 feet above the level of the sea, as at Ladrillos, commence the indications of silver, disseminated in extremely fine particles of chloro-bromide; but, on excavating, this indication soon disappears, and it is not until we reach a more elevated point that silver is found very abundantly, and where the stratification becomes more perfect.

Above the stratified porphyries there are calcareous and schistose rocks, more or less disturbed from their original position.

What is here said of the geological structure of the country east of Copiapó is true of many other parts of Chile, from the coast eastward. From these general views of the geology of Chile, I next pass to the consideration of the minerals collected by the expedition, accompanying the mineralogical description of them with an account of the manner of their occurrence. For the latter, I am also indebted to the geologists already made mention of.

GOLD.

Native Gold.—The specimens of this metal were contained in quartz rock, exhibiting all the usual characteristics of auriferous quartz. The gold contains silver, with but a trace of copper. In Chile, this metal is found in veins as well as in the drift; the whole granite of the country is traversed by quartz containing more or less gold, associated with the peroxide of iron; and, at some depth from the surface, with iron pyrites; sometimes with cupreous pyrites, arsenical pyrites, blende, galena, and sulphuret of antimony. These veins, by their decomposition, furnish auriferous deposits of considerable extent that are now worked.

Mention is made by M. Crosnier of a number of gold deposits, irregularly disseminated in the midst of decomposed granite and red clay, which contains a large quantity of peroxide of iron, and which appears not to have originated from the decomposition of regularly formed veins. This fact is apparent in the neighborhood of Valparaiso. It is also stated that gold is found in clay, more or less ferruginous, arising from the decomposition of the granite in the most elevated portions of certain mountains, and consequently in a situation where it could not have been carried by water.

It is supposed that the gold came up with the mass of granite at the time of the elevation of the latter, and not by subsequent injection of veins; and, in most instances, iron pyrites is regarded as its original associate. This character of auriferous formation is, of course, the exception, as, in most instances, the gold is traceable to regular veins, or to the decomposition of these veins. Although gold seems to be quite generally distributed through Chile, but few of the deposits remunerate exploration; the most extensive are on the flanks of the Andes, about 40 miles east of Chillan, where it exists to the depth of 35 feet in a very fine yellow clay, mixed with black sand; the yield of gold is not very great.

COPPER.

Native Copper.—This is very commonly found in all the copper mines of Chile. In one specimen, from Andacollo, (Coquimbo,) it was found crystallized in modified octahedrons; it is

very commonly associated with the red oxide of copper, as beautifully shown by a specimen from Illapel, (Coquimbo.) It is also found with copper in quartz at Andacollo, (Coquimbo.) Others of the specimens came from San José, San Pedro Nolasco, Hinchado, Higuera, and Aconcagua.

Red Copper.—This mineral is found beautifully crystallized in octahedrons, more or less modified. The most beautiful specimens of this description are from Coquimbo; other specimens are massive and granular.

Its hardness is 3.5; specific gravity, 5.9. Its color is various shades of bright red, and the crystals are transparent, although, from the exceeding intensity of their color, they must be examined by a strong light.

This mineral is quite brittle, and is composed of—

Copper - - - - - - - -	88.88
Oxygen - - - - - - - -	11.12
	100.00

Formula is Cu^2 O.

It sometimes forms veins, coated with green and blue silicates of copper, in the mines of Camarona and Cortadera, in the province of Coquimbo. In the Andacollo mine it is found pure and abundant, below the oxy-sulphuret, resting on metallic copper, with which it is very commonly mixed. Aconcagua also afforded specimens. At Illapel it is found, containing native silver.

Capillary Red Copper.—This beautiful form of the oxide of copper is found in fine delicate rhombohedral crystals. It was found in the cavities of massive specimens of the red copper, from Aconcagua. The crystals are as small as the finest hair, and sometimes half an inch in length. Its color is crimson red; specific gravity, 5.8. Its composition is the same as the last described mineral.

Tenorite or Black Oxide of Copper.—This is found massive, almost always mixed with other minerals of copper. It has a black metallic lustre, and when pure contains—

Copper - - - - - - - -	79.86
Oxygen - - - - - - - -	20.14
	100.00

Its formula is Cu O.

Atacamite.—This mineral was first discovered in the sands of the desert of Atacama, and hence its name. It is crystallized in modified rectangular prisms, and rectangular octahedrons. Its color is of a dark emerald green, almost black at times. It is translucent; has a hardness of from 3 to 3.5, and a specific gravity of about 4.00. It consists of water, chloride and oxide of copper, and contains, according to analysis of Ulex—

Chlorine - - - - - - - -	16.12
Oxide of copper - - - - - - -	56.23
Water - - - - - - - -	11.99
Copper - - - - - - - -	14.56
Silica - - - - - - - - -	1.10
	100.00

Corresponding to the formula $Cu\,Cl + 3\,\dot{C}u + 3\,\dot{H}$.

This mineral is also found in the district of Tarapaca. It is ground up in Chile, and is used as powder for letters, under the name of *arsenillo*.

Copper Glance.—The specimens of this mineral examined were all massive, of a black metallic lustre, soft, and easily cut with a knife, having a specific gravity of 5.7. It commonly has green and blue carbonate disseminated through the mass. It is composed of—

Copper	79.8
Sulphur	20.2
	100.0

Having for its formula $Cu^2 S$.

It is most abundant in those mines furthest from the coast, existing in secondary stratific porphyry, and sometimes containing a notable amount of silver. It is also found abundantly in the mines of Chile that are near the coast, and are in dioritic and porphyritic rocks; but in them it is rarely found pure, being almost always mixed with the black oxide of copper or the oxy-chloride. The specimens examined were from Copiapó, although there are numerous localities. It is remarkable that, at San Antonio, this mineral is associated with native silver, and yet often contains hardly more than one thousandth of this latter metal. Specimens of pure sulphuret of copper are found, in which metallic silver is imbedded in the form of grains or little plates; and the same sulphuret contains grains and plates of native copper, entirely separate from the silver.

Erubescite or Purple Copper.—This is one of the most abundant of the minerals of copper found in Chile. It is procured in large quantities at the mines of Tamaya in Coquimbo, Los Sapos, and Higuera. No crystals were seen. It is massive, of a purplish, variegated color, with a metallic lustre. It is brittle, and not very hard. When the surface is freshly broken, it is of a brass color, that very often tarnishes, acquiring a purplish hue. The massive varieties of this mineral always vary more or less in their composition. The specimens examined contained from 55 to 65 per cent. of copper. Three specimens, that have been thoroughly analyzed by M. Domeyko, gave—

	Tamaya.	Los Sapos.	Higuera.
Copper	66.7	56.1	59.5
Iron	8.9	17.7	18.2
Sulphur	22.8	23.1	20.5
Quartz	1.6	3.1	1.8
	99.8	100.0	100.0

The formula is $Fe S + 2 Cu^2 S$.

This mineral furnishes a great deal of the copper produced in Chile.

Copper Pyrites.—This is the most abundant copper ore of Chile, and is found in immense quantities in the province of Coquimbo; some of it, as that from Tamaya, contains .0025 per cent. of silver, while that of another mine contains gold. All the specimens were massive, of a brass yellow color, metallic lustre, fresh fractured surfaces tarnishing readily. In fact, it possesses all the known characteristics of this mineral as found elsewhere. Its composition, when perfectly pure, is—

Sulphur	35.05
Copper	34.47
Iron	30.48
	100.00

Several specimens examined gave—

	1.	2.	3.	4.
Sulphur - -	33.05	37.22	.....	.....
Copper - -	36.60	33.67	31.02	35.01
Iron - -	29.33	28.56	.....	.....
	98.98	99.45		

Its formula is $Cu^2 S + Fe^2 S^3$.

This mineral is rarely found in granite, but often in hornblendic and porphyritic transition rocks, accompanied by iron pyrites, magnetic iron, asbestos, quartz, and various species of clay; very rarely with carbonate of lime. The most important mines yielding the copper pyrites are Carrisal, Atacama, and Higuera, Brillador, Tambillos, &c., in Coquimbo.

Arsenical Gray Copper.—Gray copper appears not to be found very abundantly in Chile; there are, however, three varieties of it, one of which contains quite an amount of mercury, another having the composition of ordinary gray copper, while a third abounds in arsenic. They all three possess the ordinary physical characters of gray copper; namely, a steel-gray and iron-black color, with metallic lustre, rather brittle: hardness 3 to 4, with specific gravity varying from 4.5 to 5. No specimen of this variety was obtained. It is found at San Pedro Nolasco, and its composition, as made out by M. Domeyko, is—

Copper - - - - - - - -	48.5
Iron - - - - - - - -	4.8
Zinc - - - - - - - -	2.3
Silver - - - - - - - -	0.3
Arsenic - - - - - - - -	11.4
Antimony - - - - - - - -	6.4
Sulphur - - - - - - - -	26.1
	99.8

Mercurial Gray Copper.—This is found in some of the mercurial mines of Chile in small amorphous masses, disseminated in a quarter gangue, accompanied by the blue carbonate of copper and a red earthy substance of deep red color, apparently an antimoniate of mercury. This also has been analyzed by Domeyko, with the following result—

Antimony - - - - - - - -	20.7
Iron - - - - - - - -	1.5
Zinc - - - - - - - -	trace.
Copper - - - - - - - -	33.6
Mercury - - - - - - - -	24.0
Sulphur - - - - - - - -	20.2
	100.0

Antimonial Gray Copper.—This is the common form of gray copper, and several specimens were brought home by the expedition; it contained but a small amount of silver, as seen by the following analysis—

Sulphur	26.83
Antimony	23.21
Arsenic	3.05
Copper	36.02
Iron	2.36
Zinc	4.52
Silver	3.41
	99.40

The formula of gray copper is represented by—

$$(4\ Cu,^{2}\ Ag,\ Fe,\ Zn)\ S + (Sb\ As)\ S^{3}.$$

Besides the above species of gray copper, others are found, which, whether arsenical or antimonial, contain only a few thousands of mercury; these varieties are almost invariably destitute of silver.

Domeykite, Arsenical Copper.—This mineral is massive, of a tin-white color, with a metallic lustre, and specific gravity of 4.5. It is about the hardness of copper pyrites. The specimen examined was not a pure one; it furnished—

Arsenic	22.08
Copper	72.41
Iron	3.22
Sulphur	2.01
	99.72

Perfectly pure specimens, according to Domeyko, contain—

Arsenic	28.36
Copper	71.64
	100.00

Which give the formula $\dot{C}u^{3}\ As$.

It is found pure without any admixture of sulphuret near Illapel, in the same veins which, near the surface, yield red copper with native silver; it is also found in some of the silver mines of Atacama, particularly in those of San Antonio.

It is almost always mixed with copper pyrites in varying proportions, and sometimes with the oxide and amorphous green arseniate of copper.

Besides this species, there is found in the cordilleras a kind of white native copper, containing from 3 to 5 per cent. of arseniuret of copper and resembling native silver.

Olivenite, Arseniate of Copper.—It always accompanies the arseniurets and is amorphous, with a compact earthy structure, green color, with varying shades, and is always mixed with carbonate and silicates of copper. This mineral it appears is never found perfectly pure in Chile; but when pure, as found elsewhere, it contains—

Arsenic acid	31.78
Phosphoric acid	6.57
Oxide of copper	58.34
Water	3.31
	100.00

and the formula is—

$$\dot{C}u^{4}\ (\ddot{A}s,\ \ddot{P}) + \dot{H}$$

Chrysocolla, Silicate of Copper.—This is very commonly found in all the copper veins of Chile, always massive, sometimes in the form of mamillary coatings and concretions. It is of various shades of green and blue, sometimes of a dark and almost black color. Its specific gravity is 2.2; it is easily crushed. It is not an easy matter to find the chrysocolla perfectly pure. The specimen that furnished the material analyzed was a mass of copper pyrites, covered with a mamillary coating of the silicate, which was detached with much care. It furnished—

Oxide of copper	42.51
Silica	31.35
Water	21.62
Oxide of iron	1.97
Alumina	2.83
	100.28

Corresponding very nearly to the formula—

$$\dot{C}u^3\ \ddot{S}i^2 + 6\ \dot{H};$$

other specimens were found to contain oxide of copper varying from 20 to 50 per cent.

The name Llanca is given by miners to a silicate of different shades of green and blue, which very often accompanies the copper minerals, especially the oxy-sulphurets, forming the envelope of some veins, constituting masses in which native copper, red oxide, carbonate, and at times sulphurets of copper, are found. Most of the copper veins in Chile abound in these silicates near the surface. The basic silicate found in many of the copper mines of Coquimbo are always in the upper parts of the veins, forming narrow seams, between red oxide and green and blue Llanca; it is frequently mixed with the black silicate—La Higuera and San Lorenzo furnished the specimens examined.

Azurite, Blue Carbonate of Copper.—This occurs both crystallized and massive. Among the specimens was one crystallized on copper pyrites, from Andacollo. It possesses all the common characteristics of this mineral, as found elsewhere, and is composed of—

Oxide of copper	69.09
Carbonic acid	25.69
Water	5.22
	100.00

The formula representing it is—

$$2\ \dot{C}u + \dot{C}u\ \ddot{H}.$$

It is found in many localities, associated with the ores of copper.

Malachite, Green Carbonate of Copper.—This mineral exists abundantly in Chile, but is not found in those large compact masses, (such as are procured from Siberia and some other places,) out of which ornaments are made. It has no peculiar properties in which it differs from the malachite of other localities. Crystallized specimens were procured from Tortolas and Tamaya. Other specimens came from Tarienta, San José, &c. Its composition is—

Carbonic acid	20.
Oxide of copper	71.82
Water	8.18
	100.00

Formula is $\dot{C}u^2\ \ddot{C} + \dot{H}$.

Blue Vitriol, Sulphate of Copper.—This salt is found associated with the sulphate of iron and alumina, at Tierra Amarilla, in the valley of Copiapó. It arises from the decomposition of copper pyrites. It is constituted of—

Oxide of copper - - - - - - -	32.14
Sulphuric acid - - - - - - -	31.72
Water - - - - - - - -	36.14
	100.00

Its formula is $\dot{Cu}\,\ddot{S} + 5\,\dot{H}$.

Volborthite, Vanadate of Copper and Lead.—This rare mineral was first noticed in Chile by M. Domeyko, in the Mina Grande, about 6 miles from the silver mines of Arqueros. It is an amorphous substance, porous, heavy, and of a dark brown color. It lines the cavities of an arsenio-phosphate of lead. At first view, it would be confounded with the hydrated oxide of iron, from which it differs, however, by its great fusibility and ready solubility in nitric acid. There were no specimens sufficiently pure for analysis. Those examined by M. Domeyko gave—

	1.	2.
Oxide of lead - - - -	54.9	51.97
Oxide of copper - - - -	14.6	16.97
Vanadic acid - - - -	13.5	13.33
Arsenic acid - - - - -	4.6	4.68
Phosphoric acid - - - -	.6	.68
Chloride of lead - - - -	.3	.37
Silica (?) - - - - -	1.0	1.33
Lime - - - - - -	.5	.58
Oxide of iron and alumina - -	3.5	3.42
Earthy residue - - - -	1.0	1.52
Loss by heat - - - - -	2.7	2.70
	97.20	97.55

Giving for its formula $\dot{Pb}^6\,\dddot{V} + \dot{Cu}^6\,\dddot{V}$.

This differs somewhat from the formula furnished by the analysis of the volborthite, as found in the copper mines between Miash and Katherinenberg, Russia; but, as the Chile variety has not yet been found crystallized, the differences may be due to impurities.

Remarks on the Copper Minerals.—The minerals of copper have been described after gold, from the fact that the great mass of them occur in Chile in the same geological formation as the gold. It is the granite that is most commonly traversed by copper veins, sometimes of a considerable size. Along the coast it is found in the form of copper pyrites alone, or associated with two varieties of iron pyrites, and also as peacock or purple copper. Galena and blende are rarely found with them, and scarcely ever gray copper. Native copper, red oxide, oxy-chloride, oxy-sulphuret, green carbonate, and hydrous and an-hydrous silicates of copper, of a great variety of colors, are also abundant, especially at the upper part of the veins. The silicates sometimes line the walls of the veins, and penetrate to some distance in the enclosing rock, which becomes unequally colored blue or green. The numerous veins of copper are disseminated very irregularly in the granite, and their value is equally variable; sometimes the veins have a breadth of from 6 to 9 feet, as at Tamaya, near Coquimbo, where, at the depth of 600 feet, there is a daily yield of from 8 to 10 tons of an ore yielding seldom less than 50, and oftentimes as much as 75, per cent. of copper.

SILVER.

Native Silver.—This is found, in more or less abundance, in the various silver mines of Chile. Most frequently it is associated with dolomite, calcareous spar, sulphate of baryta, and some of the minerals of cobalt. Much of it is found in the form of thin sheets, as at San Pedro Nolasco; at Calabaço (Illapel) it is in small irregular grains; and at various mines in Copiapó it exists in the form of threads, along with native arsenic and other arsenical minerals. At Chañarcillo it occurs associated with the chloro-bromides, in dendritic forms; and at San Antonio, and some other mines, it is found in both small and large grains, in arseniuret of copper and arseniuret of cobalt. At Illapel it is found in red oxide of copper.

Silver Glance, Sulphuret of Silver.—This mineral occurs in all the mines of silver, although in no considerable quantity, and is rarely if ever crystallized. It is of a black lead color, of a metallic lustre, having a specific gravity of 7.3, and is readily reduced, on a piece of charcoal, by the action of the blow-pipe. Its composition is—

Silver	85
Sulphur	15
	100

Its formula is Ag S.

Sulphuret of Silver and Copper.—This compound is made mention of by M. Domeyko as existing in the mines of San Pedro Nolasco and Catemo. His analysis gave the following, as its constitution:

	San Pedro Nolasco.		Catemo.	
	1.	2.	3.	4.
Silver	28.8	24.1	16.6	12.1
Copper	53.4	53.9	60.6	64.0
Iron	0.0	2.1	2.3	2.5
Sulphur	19.8	19.9	20.5	21.4
	100.0	100.0	100.0	100.0

From the variable nature of its composition I should consider it merely a mixture of silver and copper glance.

Ruby Silver.—It occurs both crystallized and massive, possessing a very dark crimson red color; the color is commonly so intense that the mass appears black except when examined by transmitted light in thin pieces; it is easily cut with the knife, and furnishes silver under the blow-pipe, when heated on charcoal. Its most constant companions are native arsenic, arseniuret and sulpho-arseniuret of iron, arsenical cobalt, blende, calcareous spar, silver glance. It is sometimes found crystallized in metastatic dodecahedrons; at other times it is in masses disseminated in the midst of different spars and argillaceous gangues. It is found in microscopic crystals in the cavities and crevices of native arsenic and of arseniuret and sulpho-arseniuret of iron. The principal sources of it are at Chañarcillo in the lower part of the veins, and in other mines in the province of Atacama.

There are two distinct compositions to the dark and light ruby silver; the former being a sulphuret of antimony and silver, and the latter a sulphuret of arsenic and silver.

	Dark Ruby Silver.
Silver	58.98
Antimony	23.46
Sulphur	17.56
	100.00

The formula of this is—

$$3\,Ag\,S + Sb\,S^3$$

Light Ruby Silver.

Silver	65.38
Arsenic	19.46
Sulphur	15.16
	100.00

The formula being—

$$3\ Ag\ S + As\ S^3$$

The latter is the most common variety in Chile; one specimen, analyzed by M. Domeyko, furnished—

Silver	63.85
Iron	.96
Cobalt	.19
Arsenic	13.85
Antimony	.70
Sulphur	18.00
Gangue	1.60
	99.15

Antimonial Silver.—It is found both massive and crystallized near Coquimbo; it does not exist abundantly, is of a tin-white color with metallic lustre, having specific gravity of 9.5. This mineral is frequently mixed with arsenical and native silver; when pure it contains—

Silver	77
Antimony	23
	100

Having for its formula $Ag^4\ Sb$.

Polybasite.—Found in considerable quantity in the province of Atacama, massive, of an iron black color, and a specific gravity of 6.2; it is composed of—

Silver	66.25
Copper	4.08
Arsenic	5.22
Antimony	2.56
Iron	2.34
Sulphur	18.68
	99.13

Its formula is considered to be—

$$9\ (Ag\ Cu^2)\ S + (Sb\ As)\ S^3$$

Bismuth Silver.—In the mines of San Antonio, in the province of Copiapó, an alloy of silver and bismuth is found; its color is tin-white, high metallic lustre. The only analysis we have of this variety of bismuth silver is one by M. Domeyko; the following are the results—

Silver	60.1
Bismuth	10.1
Copper	7.8
Arsenic	2.8
Gangue	19.2
	100.0

Horn Silver, Chloride of Silver.—This is one of the most abundant silver minerals in Chile, as it is found there in quantities far exceeding anything that is elsewhere known. It is commonly massive, resembling wax of a grayish color, when the surface is freshly broken; but soon tarnishes on the exposure to light, acquiring a purplish tint. Sometimes it is of a greenish tint. Its lustre is resinous; easily cut with a knife; sp. gravity 5.4. It possesses all the properties of the artificial chloride. Its composition is—

Silver - - - - - - - -	75.33
Chlorine - - - - - - - -	24.67
	100.00

Formula, Ag Cl.

Several very fine specimens were brought by the expedition from the Chañarcillo, Valenciana mines, in Atacama, and other localities.

Bromic Silver.—This compound of silver is likewise found in Chañarcillo, and in many respects resembles the chloride; its color is greener, and it never occurs in such masses as the chloride. It is equally soft, having a little higher specific gravity—5.8. Composition when pure—

Silver - - - - - - - -	58
Bromine - - - - - - - -	42
	100

Formula, Ag Br.

Embolite, Chloro-bromide of Silver.—This mineral is found both crystallized and massive in several of the mines of Chile, in the provinces of Atacama and Coquimbo. It is less abundant than the chloride, although more so than the bromide. Externally it is greenish, internally a sulphur-yellow; it has the same lustre as the chloride; it is, however, harder than the latter; its specific gravity is the same as the bromide. The composition of it is—

Silver - - - - - - - -	66.96
Chlorine - - - - - - - -	13.20
Bromine - - - - - - - -	19.84
	100.00

Formula is, Ag (Cl Br.)

Iodic Silver.—This beautiful and rare mineral has been found in some little quantity in the silver mines of Algodones, province of Coquimbo. The mineral is of a pale, sulphur-yellow color, very fragile and soft, having a specific gravity of 5.5. One specimen that I saw had crystalline faces, indicative of a rhombic dodecahedron. It is commonly lamellar, and M. Domeyko has recognised in some small pieces three rhomboidal cleavages; two of the cleavages appear quite perfect, having a pearly lustre. It is more brittle and more fusible than either the chloride or the chloro-bromide. The presence of iodine and silver are readily recognised by the ordinary tests. Its gangue is composed partly of carbonate of lime and partly of a brick-red fine clay. In the Carmen mine, a considerable amount of iodide was found in the first part of the vein; at the depth of twelve *varas* (33 feet) it disappeared, and chloro-bromide made its appearance in identically the same gangue; and at a still greater depth the latter mineral disappeared, and was replaced by the chloride, accompanied with the sulphuret of silver. It has also been found in small quantities at one of the mines of the Chañarcillo district.

This interesting mineral has the same atomic constitution as the other natural haloid salts of silver, as originally shown by M. Domeyko; although, in referring to certain works on mineralogy, Domeyko is quoted as giving for its composition one atom of silver and two of iodine, while the chloride and bromide of silver are alluded to as constituted of atom and atom, forget-

ting that the I^2 used (as is frequently done) corresponds to I commonly used by American and English chemists, making the formula, as given by Domeyko, Ag I, which formula is sustained by my analyses, as well as those made by M. Domeyko.

The results I obtained are as follows:

	1.	2.
Iodine	52.834	53.109
Silver	46.521	46.380
Chlorine	trace.	trace.
Copper	trace.	trace.
	99.455	99.489

The formula Ag. I gives as per-centage—

Iodine	53.85
Silver	46.15
	100.00

Arquerite.—This mineral is found in great abundance at the mines of Arqueros, near Coquimbo; in fact, it is the ore of those mines. It is quite like native silver in appearance, with, however, a little more greasy lustre. It is disseminated through a calcareous rock. Several specimens examined furnished different proportions of silver and mercury, the proportions of silver varying from 83 to 92 per cent. Mr. Domeyko, who has had opportunity of examining a greater variety of specimens, gives it the following fixed composition:

Silver	86.49
Mercury	13.51
	100.00

The formula is $Ag.^6 Hg$.

In all likelihood there is a definitely constituted silver amalgam at Arqueros, but in most instances is altered by admixture with native silver.

Remarks on the Geology of the Silver Ores.—In speaking of the copper and gold veins, it was remarked, that they traversed the granite and other old unstratified rocks. M. Domeyko thinks that he has established a law in the distribution of the metalliferous veins of Chile. It is, that gold and copper veins, exempt from arsenic, antimony, and silver, abound in the granite rock; while all the silver veins, without reference to the associates of the silver, belong to the stratified rocks; and also, that the copper veins found in stratified rocks are very frequently argentiferous. M. Crosnier, however, points out two exceptions to this rule in the province of Copiapó—namely, the Pampa Larga and Garin mines. The Pampa Larga veins traverse compact feldspar, a portion of which, near the surface, is transformed into kaolin. The upper portion of the vein contains chloride, and sometimes native silver; but at a certain distance from the surface the entire mass of the vein is composed of compact native arsenic; in which we find, occasionally, sulphuret of antimony, realgar, arsenio-sulphuret of silver, (sometimes in very beautiful transparent crystals;) arsenical pyrites and calcareous spar are also found.

The Garin and Pampa Larga mines are the only two exceptions pointed out to the general law first mentioned.

The best method of furnishing a correct idea of the mineralogical and geological relations of the different kinds of silver ores, is to give an account of how they occur in one or two of the principal mines.

Some of the most remarkable mines are those in the Chañarcillo mountain, which is from 25 to 30 miles, in a direct line, from the coast. This mountain is composed of calcareous

rocks, more or less argillaceous; some of the calcareous rocks are dolomitic, while others are without magnesia. The stratification is regular, and almost horizontal. The argillaceous matter in the rocks are of two kinds—a white clay, and another composed of a silicate of alumina and iron.

This locality has been thoroughly examined by M. Domeyko, and he finds no organic remains in those parts of the mountain where the metal veins are found. The same geologist has, however, been informed that an ammonite was found in the rock of Reventon Colorado, at some distance beneath the surface. In other parts of this mountain organic remains are abundant in the calcareous rocks, especially the Turritella Andii and Terebratulæ.

From the summit of the Chañarcillo mountain to the lowest workings of the mines is a little less than 1,000 feet, and in that space there can be distinguished something like three distinct divisions in the formation of the rocks.

The plane at the summit of the mountain is composed of a dolomitic rock, having in some places a thickness of 100 feet; it consists of about one-third clay. The rock is split in all directions, and the surface of the fissures covered with small crystals of calcareous spar. In some places it is so much split that it looks more like a mass of broken rocks piled together, the interstices being filled with an earthy matter, as pulverulent as chalk, and composed of one-third carbonate of lime and two-thirds clay. It is in these fissures of the upper layer that very considerable masses of chloro-bromide of silver have been found.

The second division of the rocks differs but little in character from the last, being an argillaceous limestone; it is, however, more regular, and not so much fissured; at the same time the metalliferous veins traversing it are much poorer. The thickness of this division is over 320 feet; and here commences the third division, where the limestone contains less clay and but a little trace of magnesia. The color of the rock is a bluish gray, mottled with yellow; of a compact structure, and conchoidal fracture. This rock contains the principal wealth of the Chañarcillo mines, and in it seems to be the principal deposit of chloro-bromide of silver; the thickness of this bed is estimated at nearly 400 feet. Below this again lies another bed, where the calcareous rock is again more argillaceous, and the veins poorer. In this portion of the mountain porphyritic rocks are found at the lowest depths to which the workings have gone.

Numerous metalliferous veins traverse this mountain in every direction. The materials constituting these veins (and mixed with which the silver ores are found) are the carbonates of lime, iron, and magnesia; zinc and manganese, and the sulphate of baryta, which, however, exists in less quantity in these mines than in those in other parts of Chile. The metalliferous portions of these veins are composed principally of chloro-bromide of silver, mixed with native silver, and a small portion of sulphuret and sulpho-arseniuret of silver. The chloro-bromide does not show itself in equal abundance at all depths of the productive calcareous bed, already mentioned: it is, particularly in the upper, one or two hundred feet; below this depth the gangue becomes less and less calcareous, and the mineral changes its nature. At first it is the pure chloride, or little mixed with sulphuret; then the proportion of sulphur, antimony, native arsenic, and ruby silver commence to increase; so that, at 300 feet depth, hardly a trace of chloro-bromide is found, the silver being associated with sulphur, arsenic, and antimony.

These are the general features of these famous silver mines, and, as here described, some idea can doubtless be formed of their geological character. Although the general character of the mines resembles those just described, still the minerals and the containing rock frequently differ; thus, in the San Antonio mine, in the valley of Potrero Grande, the rock of the country is porphyry, regularly stratified, and the gangue rock of the veins a dark, ashy gray, argillaceous rock, of an earthy fracture. It is oftener found impregnated with calcareous and pearl spars, which form veins and nodules in the midst of the gangue. The iron found in these veins is in the form of protoxide, while that at Chañarcillo is in the form of hydrated peroxide. Again, the mines of this latter locality abound in chloride and chloro-bromide of silver, while on the

sulphuret of the San Antonio mine there is arseniuret and native silver. Taking the chloride and chloro-bromide as a distinguishing mark between the mines, they may be divided into two classes; those like Chañarcillo and Agua Amarga abounding in these two minerals, and those like San Antonio, San Lorenzo, San Pedro Nolasco, &c., the prominent minerals of which are the sulphuret and arseniuret of silver, with barely traces of the chloride.

MERCURY.

Cinnabar.—This mineral of mercury occurs in no great masses in Chile. It is usually found in the granite formation near veins of gold and copper, as in Coquimbo and Aconcagua; also in a vein of quartz, in some stratified porphyry, near the gold mines of Andacollo. The gangue accompanying cinnabar is quartz, with micaceous and hydrated oxide of iron. The composition of the cinnabar is—

Mercury	86.2
Sulphur	13.8
	100.0

The formula is Hg S.

LEAD.

Galena.—It is found in some parts of Chile, commonly associated with the sulphurets of other metals. Composition—

Lead	86.66
Sulphur	13.34

Formula, Pb S.

Mimetene, Chloro-Arsenate of Lead.—This compound of lead has been found, in an impure state, at Mina Grande, east of Arqueros, mixed with the vanadates of lead and copper. The analysis of a specimen by Domeyko gives—

Chloride of lead	9.05
Oxide of lead	58.31
Oxide of copper	0.92
Arsenic acid	11.55
Phosphoric acid	5.13
Vanadic acid	1.86
Lime	7.96
Alumina and peroxide of iron	1.10
Clay	2.00
Ignition	1.12
	99.00

Mimetene, when pure, has for its formula—

$$3\,(\dot{P}b, \dot{C}a)\ 3\,(\ddot{A}s\ \ddot{P}) + Pb\,Cl.$$

Vanadinite.—This is found at the same locality as the last mineral, and mixed with it and vanadate of copper and lead. It has not been discovered crystallized, nor has it been separated in a state of purity from the accompanying minerals.

Wulfenite, Molybdenate of Lead.—It is found in the province of Coquimbo, in orange colored octahedral crystals; also, in lemon-yellow plates, with the usual composition—

Oxide of lead	60.81
Molybdic acid	39.19

Having for its formula $\dot{P}b\ \ddot{M}o$.

Domeyko gives the analysis of a specimen where lime appears to replace part of the lead. It is as follows—

Oxide of lead	43.00
Molybdic acid	42.20
Lime	6.3
Peroxide of iron	8.5
	100.00

IRON.

Meteoric Iron.—This is found scattered in some parts of the desert of Atacama, in pieces from the size of a small nut to lumps weighing fifty pounds, and more. It is of a porous nature, the pores being filled by a yellowish and greenish olivine, sometimes the olivine constituting one-fifth the mass. We have no account of the falling of these meteoric masses. One specimen that was examined gave—

Iron	90.08
Nickel	9.12
Cobalt	0.39
Copper	0.03
Phosphorus	0.13
	99.75

The olivine accompanying was also analyzed—

	Pulverulent olivine.	Compact olivine.
Silica	40.50	39.51
Peroxide of iron	11.54	13.38
Magnesia	46.41	47.37
Manganese	.35	.16
Lime	trace.	trace.
	98.80	100.42

Magnetic Oxide of Iron.—Found in veins of copper at Higuera and various other parts of the provinces of Coquimbo, Copiapó, and Chillan. Its constitution is—

Iron	72.40
Oxygen	27.60
	100.00

Formula, Fe.

Micaceous Oxide of Iron.—It is abundant in Higuera and Punitaque, where it accompanies minerals of copper, gold, and mercury. Its most constant companion is gold. Small veins of carbonate or silicate of copper are frequently contained between the scales, and occasionally red oxide of copper. Its composition is—

Iron	70
Oxygen	30
	100

The formula is .

Gothite.—Commonly found in scales or plates, disseminated or grouped, and is sometimes mistaken for cinnabar. It is also found in the form of geodes, particularly in Topocalma and

Valdivia; in the geodes, marine shells (Turritella) are frequently found of very modern alluvial formation, like that in which the lignites of Conception and Colcura are found. Breithaupt called a prismatic crystalline variety of this mineral from Chile *Chileite*, without, however, any just grounds of separating it from the gothite proper. The analysis of the Chilcite, as given by Breithaupt, is—

Peroxide of iron	83.5
Water	10.3
Copper	1.9
Silica	4.3
	100.0

Formula, $\dot{F}e\,\ddot{H}$.

Pyrites.—The different varieties of iron pyrites are found in all parts of Chile. They sometimes contain an appreciable amount of gold.

Coquimbite—White Copperas.—The Tierra Amarilla, near Copiapó, is a seam of pyrites that crosses compact feldspathic rocks, and from its decomposition several minerals result. The one in question occurs in regular hexagonal plates of a yellowish-white color and pearly lustre. It has a strong, astringent taste, and is quite soluble in water. It is a neutral sulphate of iron, as shown by Rose's analysis—

Peroxide of iron	24.11
Sulphuric acid	43.55
Alumina	0.92
Lime	0.73
Magnesia	0.32
Silica	0.31
Water	30.10
	100.04

Its formula is $\dot{F}\,\ddot{S}^3 + 9\,\ddot{H}$.

Copiapite—Yellow Copperas.—This occurs associated with the last, and is most commonly found in fibrous masses, of a beautiful silky lustre when the fracture is fresh; it, however, soon becomes of a rusty color. It is not so soluble as the last, and is a basic salt.

Its specific gravity is 1.84. On analysis it furnished—

	1.	2.
Sulphuric acid	30.25	30.42
Peroxide of iron	31.75	30.98
Water	38.20	not estimated.
Undissolved	0.54	
	100.74	

The analyses correspond to the formula $\dot{F}e\,\ddot{S}^2 + 11\,\ddot{H}$.

Arseniuret of Iron.—This mineral is of metallic lustre, of a silver-white color. Specific gravity, 7.3. It is found in several of the silver mines of Chile, especially those of Carriso, where it is accompanied by mispickel, iron pyrites, blende, native antimony, ruby silver, and native silver. A specimen analyzed by M. Domeyko furnished—

Arsenic	70.3
Iron	27.6
Sulphur	1.1
Silver	.2
	99.2

The formula is Fe As.

Mispickel.—Is found with copper and cobalt minerals near Coquimbo, with copper and tungsten near Illapel, and with ruby silver, antimonial silver, and native silver in the mines of Chañarcillo, in the lower part of the veins; also near to Carriso. A specimen examined gave—

Arsenic	44.30
Sulphur	20.25
Iron	30.21
Cobalt	5.84
	100.60

The formula of mispickel is $Fe\,As + Fe\,S^2$, with cobalt replacing the iron to a greater or less extent.

Carbonate of Iron and Manganese.—This is described as a distinct mineral by M. Domeyko; but, in all likelihood, it is merely a mixture. It accompanies the sulphuret of copper and gray copper, in the silver mines of San Pedro Nolasco, in a formation of secondary stratified porphyry. This species is of a dark blackish gray and semi-metallic lustre; its structure is foliated in their laminæ diverging and grouped together in such a manner that the whole forms globular concretions, covered with small crystals of pearl spar. The mineral is soft; the powder is attracted by the magnet. It dissolves readily in cold acids, and, according to M. Domeyko's analysis, consists of—

Oxide of iron	32.10
Oxide of manganese	30.50
Lime	2.75
Magnesia	trace.
Carbonic acid	32.80
Not dissolved	.35
	98.50

MANGANESE.

Oxide of Manganese.—This is found at Arqueros, near the silver veins in secondary porphyry. The varieties that appear to exist there are psilomelane and pyrolusite.

COBALT.

Smaltene—Arsenical Cobalt.—This mineral of cobalt is found in Atacama, in transition and secondary formation, often accompanying ruby silver, native arsenic, and arsenical nickel. It occurs both crystallized and massive, possessing all the properties peculiar to this mineral. The composition of the specimen examined was—

Arsenic	70.85
Cobalt	24.13
Iron	4.05
Copper	.41
Nickel	1.23
Sulphur	.08
	100.75

The formula of the mineral is Co As, part of the cobalt being frequently replaced by other metals.

Cobaltene—Sulpho-Arsenical Cobalt.—This is found in Coquimbo, in small, brilliant, octahedral crystals, with truncated corners. It is also found granular and massive, in pieces of

considerable size. The specimens from the mines of Volcan and San Simon are of a steel-gray color, imperfect foliated structure, metallic lustre, hard, amorphous, accompanied with arseniuret of copper. It is also found associated with copper pyrites; and there is one vein of it running parallel to a vein of copper pyrites. Its composition is—

Arsenic	44.23
Sulphur	19.82
Cobalt	34.12
Iron	3.01
	101.18

The formula is $Co^1 S^2 + Co As$.

Cobalt Bloom—Arseniate of Cobalt.—It is found in all the veins containing the arseniurets of cobalt, and also in most of the silver veins, but never in any considerable quantity. At Arqueros it is found with the native amalgam, and with native and horn silver, in the mines of Argua Amarga, Chañarcillo, Punta Brava, Tunas, &c. It is crystallized in radiating crystals of a peach-blossom color, and consists of—

Arsenic acid	38.21
Oxide of cobalt	35.92
Oxide of nickel	.08
Oxide of iron	2.13
Lime	.32
Water	23.16
	99.82

The formula is $\dot{C}o^3 \ddot{A}s + 8 \ddot{H}$.

NICKEL.

Nickel Glance—Arsenical Nickel.—This is found in Atacama. It is of a steel-gray color; freshly broken surfaces soon tarnish. No analysis was made of this mineral from the above locality; and we know of none that has been made. When pure, its constitution should be—

Arsenic	45.16
Sulphur	19.33
Nickel	35.51
	100.00

Its formula is $Ni S^2 + Ni As$. Other metals, especially iron, frequently replace the nickel to some extent.

BISMUTH.

Native Bismuth.—This is found, alloyed with silver, in the San Antonio mine, Atacama. The mineral has already been described, under the head of the silver minerals. It commonly contains from 14 to 15 per cent. of bismuth.

ANTIMONY.

Native Antimony.—This is found in considerable quantity in the silver veins in the mines of Carriso. It is disseminated in small irregular veins, and in laminæ, like galena. The most constant companions of it are native silver, ruby silver, gray antimony, gray copper, &c. The gangue is carbonate of lime and heavy spar.

White Antimony accompanies the last-mentioned mineral in several of its localities. It has been found massive; is of a snow-white color, with sometimes a reddish hue. We have no analysis of this mineral from any of the localities in Chile. It is an oxide of antimony, and, when pure, should consist of—

Antimony	84.32
Oxygen	15.68
	100.00

Its formula is $Sb\ O^3$.

Antimony Glance.—This is also found in the localities furnishing native antimony, with all the ordinary properties of this well known mineral. Its composition is—

Antimony	72.89
Sulphur	27.12
	100.00

Its formula is $Sb\ S^3$.

ARSENIC.

Native Arsenic.—This substance occurs abundantly in the provinces of Atacama and Coquimbo. It is of a tin-white color that soon tarnishes; it is volatilized completely by the action of heat, and possesses all the other peculiarities of this metal. It often contains a little antimony and iron. It accompanies ores of silver, particularly ruby silver, antimonial and sulphuret of silver, native silver, arsenical cobalt, arseniuret and sulpho-arseniuret of iron. I am not informed of the existence of any other arsenical minerals in Chile, but presume the oxide and sulphuret must also be found.

ZINC.

Blende—Sulphuret of Zinc.—This ore of zinc is found near the Leona mine in Rancagua. Specimens examined by M. Domeyko contained a notable amount of iron; one of his analyses is as follows—

Zinc	43.0
Iron	12.4
Sulphur	28.6
Gangue	14.7
	97.7

Its formula is Zn S, with iron, sometimes replacing a portion of the zinc.

MISCELLANEOUS MINERALS.

Besides these minerals described, there were a few others of a non-metallic character collected by the expedition, which will be simply enumerated.

Lapis Lazuli.—This beautiful mineral occurs in no inconsiderable quantities in the province of Coquimbo. Carbonate of lime runs through the mass, in small veins, and iron pyrites is intimately mixed with it in small crystals. It being impossible to separate the two last mentioned minerals from the lapis lazuli, no analysis was made of it. A specimen of the mineral from the Andes was analyzed by Mr. T. Field, with the following results:

Silica	37.60
Alumina	11.21
Sulphur	1.65
Iron	0.08
Magnesia	0.36
Soda	9.66
Lime	24.10
Carbonic acid	15.05
	99.71

Although this analysis differs somewhat from the mineral procured from other localities, still the difference may be accounted for by the unavoidable impurities.

Calcareous Spar.—This is found in all parts of Chile, and is one of the most common gangue rocks of the silver ores.

Dolomite.—This is also a common mineral in Chile, forming in many places beds of immense thickness.

Heavy Spar—Sulphate of Baryta.—Exists in the silver veins forming ore of the gangue rocks.

Asbestos (green.)—A specimen was brought from the copper mines of Coquimbo, and another from Tambillos.

Tungstate of Lime.—This mineral is found in the copper mines of Llamaco, near to Chuapá, and contains about three per cent. of oxide of copper in its constitution.

Lignite.—This variety of coal has been found in some little abundance at Concepcion, and is worked to some extent. These lignites ordinarily form but one seam that is thick enough to repay exploration; it is often accompanied by a second thin seam and one more irregular. It is seldom that the seams are found more than 6 or 9 feet above the level of the sea, and most always dip to the west beneath the ocean. It has been found on the shores of Concepcion, of Valdivia, and on the shores of the island of Chilóe. The mines that have been worked are, one near Penco, another near Lirquen, the mines of Talcahuana, of Las Tierras Coloradas, of Lota and of Lotilla; the two last mines are considered those of most importance.

M. Crosnier gives the analysis of several of these lignites, as follows—

	Lota.	Lotilla.	Penco.
Coke	52.3	42.7	39.9
Volatile matter	44.6	54.3	51.8
Ash	3.1	3.0	8.3
	100.0	100.0	100.0

The coke is light and porous; it is sufficiently solid when well burnt.

MINERAL WATERS.

Five specimens of mineral waters were submitted to examination; but as there was only about one pint of each, the analysis cannot be considered as satisfactory as it is desirable that they should be.

No. 1. From the baths of Apoquindo, east of and about 500 feet above Santiago, in the first range of the Andes. When the water was collected its temperature was 74°, the air being 57°.

The specific gravity of it is 1.00226.

Solid contents in one litre 2.743 grammes, composed of—

	Gram.
Chloride of calcium	1.665
" " sodium	1.008
" " magnesium	trace.
Sulphate of lime	.032
Oxide of iron	.018
Organic matter	trace.
Silica	.020

No. 2. From the baths of Colina. The temperature of the water at the source is 89½° Faht.; sp. grav. 1.00053. The amount of solid contents in one litre are 0.428 gramme, composed of—

Sulphate of lime	.120
" " soda	.089
Chloride of calcium	.077
" " sodium	.142
Oxide of iron	trace.
Organic matter	trace.
Silica	trace.

No. 3. This is also from the baths of Colina, and when collected was 79° Faht.; sp. grav. 1.00045. The composition of the water is the same as the last. Solid contents in one litre 0.435 gramme, composed of—

Sulphate of lime	.118
" " soda	.094
Chloride of calcium	.087
" " sodium	.136
Oxide of iron	trace.
Organic matter	trace.
Silica	trace.

No. 4. From Cauquenes *Tibia* bath; sp. grav. 1.00270; solid contents in one litre 3.3032 gramme, composed of—

Sulphate of lime	.0600
" " soda	.0320
Chloride of calcium	2.1682
" " sodium	1.0310
" " magnesium	trace.
Oxide of iron	.0020
Organic matter	trace.
Silica	.0100

No. 5. Cauquenes *Pelambre* bath; sp. grav. 1.00283. It is constituted the same as the last. Solid contents in one litre 3.3923 gramme, composed of—

Sulphate of lime	.0630
" " soda	.0410
Chloride of calcium	2.1751
" " sodium	1.1012
" " magnesium	trace.
Oxide of iron	trace.
Organic matter	trace.
Silica	.0120

Analysis of water brought from the Rio de Mendoza, by Lieut. MacRae.

The bottle contained a large amount of mud sediment. The clear water, on evaporation, gave 540 grammes of solid matter to the litre, composed of—

Carbonate of lime	.110
Carbonate of magnesia	.072
Sulphate of lime	.792
Sulphate of magnesia	.108
Sulphate of soda	.192
Sulphate of iron	.036
Chloride of sodium	.228
Silica	.112
Organic matter	.150

APPENDIX E.

A DESCRIPTION OF THE INDIAN ANTIQUITIES

BROUGHT FROM

CHILE AND PERU,

BY THE

UNITED STATES NAVAL ASTRONOMICAL EXPEDITION.

BY

THOMAS EWBANK.

A DESCRIPTION OF THE INDIAN ANTIQUITIES BROUGHT FROM CHILE AND PERU, BY THE U. S. NAVAL ASTRONOMICAL EXPEDITION.

BY THOMAS EWBANK.

Surprising as are the mutations which the earth has undergone in her internal and external features, they are not greater than those to which man is subject. With him, as with it, nothing is intended to be stationary. An upheaving power is always at work on the deep strata of human influences, and hence the ancient elements of his existence are here and there breaking up and arranging themselves in new forms. Usages and institutions adapted to his infancy are becoming obsolescent. Instead of prostrating his intellect to tradition, and yielding passive submission to puerile errors and old organized wrongs, he is beginning to be agitated by a different order of wonders. Miracles are emanating from the workshop, and marvels of science taking the place of legends and legerdemain. A spirit of keen and comprehensive research is inaugurated. Besides contemplating the present and anticipating the future, he looks to the past, and longs to know what his species have been doing on the earth, what parts of it have been occupied, and how long.

At present we have little more knowledge of the past career of mankind than of that of the planet; not even as much, for history, such as it is, is limited to a fraction of the earth's population, goes back but a little way, and is then lost in the void beyond. It is at best like a turbulent geological epoch—a broken record of successive paroxysms of mental darkness and of physical commotions. It is not four centuries since the existence of the red race and of the Western Continent were announced, and not half that time since the Australian and Polynesian regions were made known. Of the early inhabitants of this hemisphere nothing is known. Their origin, epoch, and deeds, are alike shrouded in silence and gloom—in darkness so dense that not a ray of light has been found to penetrate it. Even of their successors or descendants, so late as three centuries back, we have learned but little, and still less of their arts; much less than ought to be known, considering the opportunities for collecting information that have occurred. But a better feeling is becoming manifest, and numerous and systematic efforts are being made to recover, as far as possible, the history of a people we have superseded, and one apparently on the eve of disappearing forever.

But can anything be now ascertained of remotely extinct peoples whom history does not mention? Certainly. Except unreclaimed savages, few people have passed away without leaving their marks in pottery and in some of the metals, if in nothing else. The earth is more or less charged with such remains, and they are unimpeachable witnesses of the condition of the people who owned them. Since the discovery they have been dug up both in South and North America, and will assuredly abound more and more as civilization sweeps over the forests; nor is it at all improbable that specimens of a higher order than any yet found of these medallions of aboriginal arts will be disinterred, and such as may equal in interest those recently found in the debris of Babylon, Nineveh, Sidon, and other oriental cities.

To gather together the scattered fragments of Indian art is neither useless nor profitless. Could we obtain a knowledge of the means by which the old race of artisans and engineers of

Mexico, Central America, and Peru achieved their best works, there is little doubt that not a few of their devices would be found new, and consequently more or less valuable to us. Whatever may be said or thought of the barbaric splendor of Montezuma's and the Incas' establishments, there was genuine ingenuity in the native mechanics of those days. Indeed, semi-civilized manners and tastes have little to do with efficient devices and processes for working metals and other materials, whatever they may have to do with the forms into which these are wrought or the purposes to which they are applied. But there is no information on aboriginal arts, however trifling, that is valueless; did it only reflect light on the workings of the Indian mind, it would be of service, throwing practical suggestions out of the question.

The following articles were brought up from various depths beneath the surface, and in soil that probably was equally calculated to preserve them as the catacombs of Egypt.

Plate VIII.—*Metallic Implements.*

The principal object represented on this plate is a copper axe, found in a great *quebrada*, in the province of Atacama, Chile, not far from where the *Camino de los Incas* diverges round a hill called Tres Puntas, in latitude 26° 42′. This road commences near the city of Copiapó, proceeds in nearly a straight line in a north by east direction until it reaches the base of Tres Puntas, passes round the hill—7,000 feet high—and resumes its former direction. It being one of the great avenues opened by the Incas into their conquered provinces, remains of Peruvian manufactures have frequently been found on it as on others. This axe is an example. It is believed to be Peruvian, as the old Chilenos had no knowledge of working the metals. No such implements as those figured on the plate have been found in their burial-places.

The metal of this axe has not been artificially alloyed. It has been *cast*, weighs three and a quarter pounds, and has seen much service, as appears from its battered appearance and from smoothly-worn grooves at the sides and edges where the handle was lashed to it. It was probably used, as we believe most such tools were, more in the manner of an adze than of an axe; that is, the handle seems to have been placed at right angles to the face of the blade, not parallel to it. To the slight movement of the end of the handle that butted against the blade the indentations at the sides may possibly be due, while the polished grooves at the edges are obviously the effect of the play of the thongs that bound both together. The studs cast on the edges below the T-like extension at the top constitute the most interesting feature in this axe, because they inform us of a previous existing difficulty. They were designed to prevent, and they effectually did prevent, the lashings, and with them the handle, from slipping down below their proper place. The cutting edge was kept in order by hammering. For an inch above it, where the thickness of the blade begins to diminish, the whole is covered on both sides by rough marks of rounded hammers, which were probably of stone. The effect of this is seen in the metal being forced over the general surface at the sides; and a further result is, that the width of the cutting edge has been considerably increased from what it originally was. After bringing down an edge with hammers, a finish was given by rubbing it on coarse and fine-grained stones. A narrow border on each side of the extreme edge shows where the marks of the hammer were thus obliterated. To a limited extent the cutting parts of these ancient tools were rendered harder than the rest, an effect of their constant condensation by the hammer. The surface is black almost as ink, but it appears to have suffered little or nothing from corrosion.

As the Peruvians had, long before the Conquest, bronze maces and axes into which handles were inserted as in our hammers—specimens are preserved in several collections—it may be inferred that this instrument belongs to a remoter period of their history. That it, and such as it, were preserved from generation to generation by tribes remote from the capital after better ones had been introduced there, is not simply probable—it is certain; and hence the date of such things cannot be determined by that of the *huaca*, or grave, from which they are taken, even if

Full size.

J M Stanley del[l]

P S Duval & Co steam lith press Phil

INDIAN ANTIQUITIES.

that could be made out. This axe was doubtless a costly one at the time it was made, and the families successively owning it may never have had the opportunity or means to obtain a better. The durability of such a tool, it should be remembered, is almost eternal. Five thousand years could make little impression upon it. If not lost, there is nothing to prevent its appearance in a museum after the lapse of fifty centuries, and without any sensible change from its present appearance.

The studs for confining the cord fastenings to their places, show that it does not belong to the *primitive* class of metallic axes, since they had no such useful feature. These projections, too, are interesting in another point: they make us acquainted with a device that was intermediate between the first rude contrivance and the final one for securing the handle to the blade by insertion.

As the ancient Peruvians discovered tin, and employed it somewhat extensively to harden copper, this axe probably dates from a period anterior to that when bronze ones were first made. It is difficult to suppose that such a people would continue to make blades of soft copper when they had tin in abundance to render them so much more efficient.

Stone and copper axes are medallions of the arts in the first and second cycles of human progress—the very best that we could have, for they furnish more definite ideas of the early condition of our species than volumes of printed speculations. The stone axe is erroneously associated in the popular mind with the felling of timber; but certainly a tree was never *cut down* by it. The thing is evidently impossible, when the material of the tool, its thickness, and blunted edge are considered. When not used as a weapon, the chief employment of the stone axe was as a wedge to split wood, and as a scraper to dig into and remove the charred parts of trees and timber. It made no impression on the forest, and hence the log-hut was unknown in the age of stone. When it was desired to prostrate a trunk, or to scoop it out for a canoe, *fire* was the chief operating agent. All the cutting of wood before metals were introduced was confined to carving and whittling by obsidian knives, flints, and shells.

The revolution that began with the introduction of axes of copper was only less than that caused by those of iron. Wood could then be cut and chopped, though but rudely and feebly. The superiority of the new instrument was, however, palpable: it was smaller and heavier than its predecessor, and hardly one third as thick in the blade; while the cutting edge, whenever blunted or bent, was readily sharpened and made straight. It was not liable to fracture; while a gap in a stone one, if not fatal, required weeks of labor to bring up a new edge by abrasion. But, after all, it is difficult for us correctly to imagine how vast an amount of labor was expended in wielding copper axes, and with what slender results. A stone axe tells us at once the condition of peoples who had none other, and one of copper is a true index of the arts wherever iron is not known. It is, then, no wonder that, from the day this half of the globe was opened to the other half, the eager demand of the aborigines for cutting-instruments of steel has not ceased.

The remaining articles figured on this plate were found near the village of San José, on the river Maypu, in Chile, by a party of laborers engaged in digging a canal. Human remains, which crumbled to dust on exposure to the air, were disinterred with them. They are of unusual interest.

At the right of the axe is another copper implement nearly $3\frac{1}{2}$ inches long, one quarter of an inch thick at the thickest part, three quarters of an inch wide at one end, and $1\frac{3}{8}$ inch at the other. It is of pure copper; it has been cast, and the cutting end drawn out with the hammer. Although called a chisel, on account of its shape, it has never been used as one; there are no marks of blows on its upper end. It was undoubtedly used as a knife, and so were all, or nearly all, stone and metal implements of the kind. Their resemblance to our chisels has naturally led many to consider them such.

Adjoining the axe on the left, is a long and tapered tool seven inches in length, and one eighth of an inch in thickness; it is half an inch wide at one end, and one sixth of an inch

at the other; both ends are sharpened into cutting-blades. The metal, of a dull yellow color, is hard, light, rings well, and weighs an ounce and a quarter. The proportion of tin probably approaches six per cent. The surface is corroded, and the sharp, cutting edges are jagged.

Alongside of the last figure is a similar tool, but larger, being nearly nine inches long, half an inch wide at one extremity, and three fourths of an inch at the other. The cutting edges are rounded like those of the smaller one, and the thickness varies but little from one eighth of an inch; weight, two ounces. The metal is a perceptible shade darker, and, as might be inferred from that circumstance, not quite so hard. It contains, perhaps, about five per cent. of tin. The surfaces are corroded, but not so much as those of the preceding figure. A number of slight depressions mark both sides, as if it had been stretched lengthwise by the pin of a hammer, though the composition would seem hardly tough enough to bear that.

Grasped by the middle, these two instruments would even now be no bad substitutes for steel ones for cutting leather, cloth, skins, and other thin materials stretched upon a table, and even for entering soft woods, either in the direction of or across the grain. As drills, they would be quite sufficient for boring into numerous substances. There are, in Boturini's Collection of Mexican MSS., (Sec. III, No. 3, of his Catalogue,) figures of artisans carving with and otherwise using such tools. Simple as they seem, there are good points about them, and even in their forms and proportions. Being tapered in width, every instrument presented two blades, and two different sized ones; while, from the limited and uniform thickness given to the body of each, the least amount of labor was required to restore the cutting-edge when blunted or broken. No forging was wanted; nothing but simple abrasion or grinding. Another capital feature which we, in the midst of iron and steel and the facilities for working them, can hardly appreciate, was, the tool was never worn out until used up. While an inch remained, it could be used by sticking one end into a handle. It is very probable that the form and proportions of these instruments were given to all hard cutting-tools; while such as were malleable were, like our stone-cutters' chisels, and like the two copper tools, made thicker in the body, and thinned down towards the edges by the hammer.

A Peruvian knife proper, with a curved blade, is represented in full size below, interesting from its resemblance to those used by modern glovers and saddlers, and by Egyptian harness-makers under the Pharaohs. They have been found variously modified in form and hardness. I met with others more elaborately worked in the handles, in collections of South American antiquities. Very plain ones, as if hammered out of sheet metal, occasionally occur. Like the preceding figures, this instrument was cast, and cast whole. There is an appearance, where the handle joins the blade, of something like welding or soldering, but which is, I believe, due to the junction in the model. The application of nitric acid did not detect any solder. The blade measures $4\frac{3}{4}$ inches along the back, which is rather over one eighth of an inch thick, except towards the ends, where it tapers down to the sharpened edge. The handle is cylindrical, three eighths of an inch thick, and moulded in imitation of an inverted bird's leg and foot. When used, the right hand grasped the shank, while the ball of the thumb rested between the open claws. In this way a firm hold and control of the blade was secured. The metal is slightly softer than that of the two other bronze tools. The instrument has obviously gone through much work. The widest part of the blade is $1\frac{1}{8}$ inch across, which was probably about the original width of the segment. The ornamental marks cast round the shank are nearly worn out.

With the proprietor of these tools was also buried his whetstone—an indispensable article to every workman in wood and metal with us, but of much more frequent necessity to artisans whose edge-tools were of bronze. It is represented by the remaining figure on this plate—a compact piece of slate $2\frac{5}{8}$ inches long, three eighths of an inch thick, and varying from three quarters of an inch to an inch in width. A small hole is drilled through one end, most likely for a cord to suspend it by. A deep, angular depression has been worn on one side by sharpening tools on it, and a shallower one on the other. So similar is it to such things in modern

One third natural size

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workshops, and so little change has time wrought in it, that it might readily be taken for a piece of a carpenter's hone.

Peruvian cutting-tools of bronze which I have met with have been comparatively little hardened, the proportions of tin not exceeding from two to three per cent. Now, why was this? Because old workmen preferred keeping them so far malleable that they might be readily thinned by the hammer, and have only the finishing-edge to put on by the hone, to making them brittle and hard, when nothing but tedious abrasion could restore or bring up a jagged or broken blade. From these small amounts of tin, some writers have surmised that the knowledge of giving different degrees of hardness to copper by varying the proportion of tin put in was not known, and that the alloys were natural ones. There are too many facts to overthrow and too few to sustain this hypothesis. The instruments described in this paper are of different degrees of hardness, and are certainly artificial compounds. They have by far the hardest cutting-edges of any I have ever seen, and show clear enough to my mind that the knowledge that copper is hardened in proportion to the quantity of tin mixed with it was possessed in ancient Chile and Peru, in Mexico and Central America; that it could be made as hard as bell-metal that resists the file; and that brittleness kept pace with the hardness. Bells, we know, were made before the conquest in Peru, Mexico, and Mechoacan, and of alloys of gold as well as of copper.

I think these tools go far to explain some matters relating to remote American civilization that have hitherto been sore puzzles, though they may be insufficient wholly to account for the dressed stone, the porphyritic and other sculptures of Cuzco, Uxmal, Palenque, &c.

Plate IX.—*Pottery.*

With the exception of figures 10, 11, 12, the pottery represented on this plate was taken from a family tomb near Arica, in Peru. Figures 1, 2, 3, 4, 5, were intended to heat as well as to hold liquids. None of them has ever been glazed; nor have the slightest efforts at ornament been expended on them. In texture, hardness, materials, and rough feeling to the touch, they resemble our sand crucibles, and were possibly as well adapted to endure heat. Their capacities are, respectively, three quarts, one quart, one quart, a pint and a quarter, two pints and a half. These measures are not minutely accurate, but quite sufficient for the purpose of this description.

The bottoms of all are convex externally, and somewhat conical. There was a reason for this. The scarcity of fuel led the ancient Peruvians to a device for economizing it identical in principle with that of the classical ancients, and of most of the peoples of the eastern world—one still common to all the Latin nations, and the application of which has become a standing feature in our cooking-stoves and ranges. They confined the fire between two low walls, (which formed, in fact, a shallow, horizontal flue,) and placed upon them a plate of stone, having cut in it a row of two, three, or more openings suited to receive the pots and caldrons, and allow their lower halves to descend into and interrupt the passing flame. Thus, the heat not taken up by the bottom of the first vessel passed on to the second, &c., so that, when the smoke escaped at the end of the flue, the greater part of the heat had been absorbed by the pots.

Figures 6, 7, 8, 9. Four stoppers or covers. The vessel to which No. 9 belonged was probably broken in opening the tomb, as it has not been received with the rest. All are hollow, of the same hard material as the vessels, and pretty uniform in thickness—from one eighth of an inch to three sixteenths. Each has a hole at the smallest end, as represented. These covers are in some respects superior to our close-fitting pot-lids, since a vase could never be exploded by an accumulation of steam. Ordinarily, the vapor would escape between the stopper and the cavity in which it rested; while a sudden evolution of steam would partially, and for a moment only, raise the stopper. It could never be blown out of its seat during the absence or in the presence of the cook.

The vessels 1 and 5 show marks of having been much used; while the appearance of 2, 3, and 4 indicates that they were new, or nearly new, when interred. The loops moulded on 1, 2, and

5 answered to the studs on No. 3: they were substitutes for handles. Their interior surfaces are ragged in the extreme. No strings by which to suspend them could have been used without being quickly cut through.

But the most interesting feature in these pots is one which shows they were not exclusively formed by hand. It has long been and still is conceded that nothing like the potter's wheel was employed on aboriginal wares; a proof, strong as that afforded by the native modes of spinning thread and grinding corn, that the elements of American civilization were independently developed. In every instance the lower portion has been formed *on a mould*, (and most likely between two moulds,) while the upper halves were gathered in, and the necks modelled by the hands; the marks and irregularities of which are apparent, and singularly contrast with the interior surface below, which is so perfectly uniform that nothing but a mould could produce the like. Nos. 2 and 3 seem to have been formed on one mould.

Figures 11 and 12 are from the same tomb, in Chile, out of which the bronze implements figured on Plate 1 were taken. They are of a softer material and of a finer grain than the preceding, and, being glazed, are quite smooth to the touch. They belonged to what may be called the fancy pottery of old, being intended for show as well as for use. The saucer-like vessels, Nos. 10 and 11, have handles formed after birds' heads: one resembles that of a duck or goose. No. 10 is from Cuzco; it is $5\frac{3}{4}$ inches in diameter, and three quarters of an inch at the centre. No. 11 is $6\frac{1}{4}$ inches across, and $1\frac{1}{2}$ inch deep. Each has a couple of studs on the edge opposite the handle, on which to rest it on the shelf. This is a common feature in all Peruvian pateras; I do not remember to have seen one without it. Thus ancient American housewives, like housewives everywhere, took a pride in setting off to advantage their handsome crockery.

Plate X.—*Wooden-ware, &c.*

With the five cooking vases, figured in the preceding plate, were found various articles of domestic economy in wood; of these, figure 1 is the most conspicuous. This neat little pipkin has been cut out of a solid piece of moderately-hard and red-colored wood. The sides and bottom are of proportionate thickness, and the former thinned towards the spreading rim. But the design is better than the execution; the vessel bears marks of the tedious process by which the interior matter was scooped out, morsel by morsel, and the exterior dressed down. The bust which forms the handle is characteristic of the ancient head-dress, and of the gathering of the hair behind into a thick queue—a custom still pursued among the Pueblo Indians and those of the Gila river. The diameter of the bottom is $4\frac{1}{2}$ inches, across the rim $6\frac{1}{4}$, and the depth $4\frac{1}{4}$. The broad band beneath the rim, and the narrow one near the bottom, are calculated to convey the impression that they were carved in imitation of hoops put around vessels made of staves. If such was the fact, the date would have, perhaps, to be brought down below the Conquest: that is, supposing vessels constructed of staves were not known to the natives during the Inca dynasties. The probability, however, is, that the projecting parts were carved for ornament, without reference to hooped pails and casks, as analogous bands are found on some of the oldest of their gold and silver cups and vases.

Figure 2 is a rude wooden spoon, probably used with the vessel figure 1. It forms a perfect contrast to the exuberantly ornamented ones by modern Indians of Peru. The edges of the bowl are worn, the front part thinned away, and the natural red tint of the wood reduced nearly to white, most likely by stirring corn-mush or cassava in the pipkin, and transferring it thence to the family mouths.

Figure 3. A dipper or drinking bowl made out of a calabash.

Figure 4. A small and nearly globular gourd, probably used for a similar purpose.

Another example of minute toil in carving is shown at figure 5, apparently in imitation of a small gourd.

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In *figure* 6 are four irregularly-formed receptacles made in a piece of wood, only 1½ inch wide, not quite 2 inches long, and only five eighths of an inch thick. Unless the cavities were for rare condiments or pigments, I cannot imagine their use.

The most laborious efforts at carving which the tomb has revealed are displayed in three sharply elliptical vessels—all of the same material, form, and, as nearly as may be, dimensions.

Figure 7 represents one of them. Of a pale-yellow colored wood, its longest diameter at top is 6 inches, its shorter one 2½; the depth is 3¾ inches, and the bottom measures 3½ by 2¾ inches. See A and B. Both sides, the inside especially, are covered with innumerable fresh-looking marks of the imperfect tools employed, clearly indicating that the vessels had been little used since made. Their design is a perfect enigma; and the puzzle is made still more perplexing by two holes, nearly half an inch square, cut through the bottom of each (see A and B;) in addition to which, there are two minute perforations, about one tenth of an inch in diameter, drilled through the ends just above the bottom, as if for the purpose of passing a wire or small cord from end to end through the interior. One of these holes is shown in figure B.

Figure 8 is a coarsely-plaited basket, 6½ inches long by 4½ broad, and 4½ inches deep. It is made of rushes, whose ends retain their cylindrical form; they slightly exceed one eighth of an inch in thickness.

In this basket were some ears of Indian corn, much shorter than any variety cultivated with us. They are from four to five inches in length, the cobs being three quarters of an inch in diameter. The grain is narrow and deep, and resembles the gourd-seed corn of the southern States. The rows vary from twelve to sixteen.

There were also some sweet potatoes in the tomb; but they crumbled on exposure to the air, and could not be preserved.

Figure 9 is a neatly and closely woven basket, or bowl, 5½ inches in diameter, used for holding liquids, and which it would still retain, although a portion of it has disappeared from dampness. It contained some small matters—as several rods, 4¼ inches long, perforated lengthwise through the centre, and leaving two notches near one end, opposite each other, and communicating by a transverse hole. (See figures 10.) There were smoothly-shaped slips of a hard and cocoa-colored wood, whose purpose it is difficult to determine. (See figures 11.) They would have made excellent teeth for native combs.

There were also six sticks, varying in length from 14 inches to 6. (See figures 12.) Three of these have holes worked out at one end. All have been colored red, and one with red bands. Their use is not known.

There were found with these things two metallic objects, which are, therefore, figured with them. Figure 13 is one: it is a nodule of ironstone, which Garcilasso, the Inca historian, says his countrymen occasionally used as a material for tools, and which they named *quilley*. This may have been the upper part of a chisel or punch, for which it seems to have been well enough adapted. From the fracture, a considerable part appears to have been broken off. The figure is of the natural size.

Figures 14 and 15. A bronze bodkin, which the finders mistook for gold. The alloy is similar to that of the third figure described on Plate VIII. It has been cast, and towards the point is smooth. The extreme point has been broken off. The instrument might be serviceable in many operations in modern arts. At the upper end is a slit, either artificial or from a flaw in the casting. About an inch of the upper part was wound thickly round with thread of Llama wool, and then covered with interlaced reed, making a secure and excellent handle. There was no moving the instrument from its haft but by cutting through the latter, so firmly were both secured together.

Figure 16 is an equally interesting instrument—a primeval needle, made of a cactus thorn. It is strong, elastic, black like polished ebony, and as sound as ever it was. The end has been flattened where the eye is. Portions of a fine thread remain in the eye, as well and uniformly twisted as any in modern ladies' work-baskets, and composed of *five* distinct strands or separate threads.

With other primeval inventions, the needle elicits little observation, it being with things as with persons: the showy and superficial push aside the unobtrusive and useful. To some minds this fac simile of an instrument used by Eve and her daughters, and by their early descendants, may appear too trifling an affair to be worth recording; but few things offer in its associations more agreeable instruction. In its progressive development, through wood, bone, copper, bronze, and iron, into its modern steel representatives, and in the ameliorating and refining influence it has exercised over our species, the needle lacks neither point to awaken interest nor piquancy to keep it awake.

The remnant of fine thread left in the eye is also connected with a subject that is equally interesting. It presents an opportunity of explaining a remark of Garcilasso, which appears irreconcilable with the fact that American spinsters twirled the spindle in a shell, gourd, or hollow stone, resting commonly on the floor, or the lap. He observes that his countrywomen carried their spinning apparatus with them to social parties, and, like European and Asiatic females, spun as *they walked through the streets or into the country.* Mentioning the difficulty to the late amiable and able envoy extraordinary from Costa Rica, Guatemala, and Salvador, to the United States, Don Felipe Molina, he removed it at once, by stating that the practice is still kept up in those States, and particularly by Indian *men*, who are singularly industrious, and who almost always thus occupy themselves when travelling with loads on their backs. They whirl the spindle in a small cylindrical gourd, secured to the breast, or lodged in a pocket of their jackets.

Figure 17. A beautifully ornamented cap, knitted or woven out of Llama wool. It is stout, and, except the colors and figures formed by them, is in pretty good preservation. Two strong cords, each a foot long and with a knot at the end, served to tie it under the chin. The diameter of the crown is 5½ inches; depth of the rim, two inches. The process of formation began at the centre of the crown, as in Leghorn bonnets—the main threads extending outwards spirally. A small opening is left in the centre, and doubtless with the same view as similar ventilators are made in modern hats. The texture of the cap is very closely woven. Black, red or brown, yellow, green and light green, are the colors that remain.

Figure 18. A portion of the cloth in which the mummies were enveloped. It is worth remarking on this fragment, that it has a feature more or less common in the fabrics wrapped round Egyptian mummies, viz: in the different sizes of the yarns that compose the weft and the warp. The same thing occurs in some fine Navajo blankets which I have examined, though the difference in them was not near so much as in this Peruvian Cere cloth. Another trait, common to ancient and modern Indian loom-work, is, that two yarns were sometimes used in the weft to one in the warp.

The head of the entombed family was no warrior, since no weapons were buried with him, unless a sling (figure 19) netted from Llama's hair be one. One of the cords is 2½ feet long, the other a foot shorter. It appears to have been little used, and is still strong enough to answer the purpose for which it was wrought. This absence of weapons, and the presence of a large number of domestic and industrial implements, is a pleasing and impressive characteristic of old Peruvian civilization.

After the foregoing sheets were in the hands of the printer, the contents of another ancient grave near Arica, which had been accidentally delayed, came to hand. As there was not time to have suitable illustrations prepared, a brief description of the relics are subjoined, since they are of too interesting a character to be wholly omitted.

From the condition of some, if not all, they may be centuries if not decades of centuries old. They consist of movables of a family—of things that were never left behind on a change of location. Valuable on earth, they were believed to be equally desirable in the land beyond the setting sun, to which their owners supposed they emigrated at death. Here are ears of corn, and grains carefully sewed up in a bag to plant there, with vessels in which to cook them;

hooks to catch fish there, arrows to kill game, and implements of male and female industry, with smaller matters to please their children. There is something affecting in the members of a family being thus accompanied with their little stock of valuables on their exodus out of this world in quest of another. Happily, they had no idea that their treasures would be stolen here, and even their own bodies borne off as curiosities, by people of another race.

A few articles are in *copper* and *bronze*, all deeply corroded and swelled beyond their natural dimensions by blossoms of green oxide.

1. The triangular blade of a knife rather more than two inches across the cutting-edge, perpendicular to which arose a plain and flat handle. A part only remains, three sixteenths of an inch thick. The alloy is similar to that of the knife on Plate VIII. A little forked piece (of wood probably, though it is reduced to the color and consistence of caked snuff) has been secured by twine over the stump, and gives a smooth termination to the shank.

2. A fish-hook of bronze about the size of a mackerel hook, half an inch across the bend, the short end 1½ inches, and the other end longer. The last had been attached to a slip of bone or wood: the lashing was remaining round both. On dissolving the oxide by an acid, the metallic portion remaining was found to be one eighth of an inch thick at the bend, and to taper thence to both ends. If there had been a barb at one and a notch or loop at the other, they had been eaten away. This hook is stiff, and as difficult to bend as if it had been made of iron.

3. A similarly formed but smaller hook. The shank is 1¼ inches long, and retains the lashing that attached it to the fishing-line. The only observable difference in the contour of these hooks and of ours is the greater length given to the short ends; possibly to compensate for the absence of barbs.

4. A still smaller hook, half imbedded in a portion of the line that had been buried with it. In dimensions it resembles those temporary hooks made by boys of pins. To attempt to remove its bright green envelope would probably destroy it.

5. Another hook (a straight one) a little over two inches long, with a barb neatly tied on. Like the others, the finely twisted line has disappeared, except some small portions imbedded in the copper rust.

6. A singular looking article, and one whose use it is next to impossible to divine. At the first glance upon its arrival, when its general and rough contour only was observable, it had some resemblance to the handle of a sword with a portion of the blade projecting from it; but then there were two shapeless protuberances that increased the difficulty. After dissolving the encrusted covering in an acid, and "pickling," (to use a brazier's phrase), so as to bring out a clean surface, the relic assumed another appearance, but one as much of an enigma as before. A very definite idea of it cannot be communicated without a drawing.

For the purpose of description, let it be supposed an insignia of office worn on the hand. It is an elliptical band, with an opening three and a half inches one way, and an inch the other. It might be slipped over the four fingers till one end was between the thumb and forefinger. The upper surface passing across the back of the hand is an inch wide, and ornamented with sunken scroll or square work. The part in contact with the palm is plain, and not half so wide. From one end is an ornamented projecting piece 1½ inch long, and nearly as wide as the band. It rests on the thumb if the band be slipped on with it in that direction, or extends at right angles from the little finger if the band be slipped on reversely. This piece has a longitudinal slit, which divides it in two, except at the junction with the band, where the casting is very perfect. But the most curious part consists of two figures (apparently of Incas from the head-dresses) rising from the middle of the band. They project over an inch, are within three quarters of an inch of each other, and both look one way, with their backs to the above-named projection. They are in a sitting posture, holding cups, or something else, to their mouths; and minute as they are, the arms, legs, and thighs are singularly relieved. As a piece of casting, it is a surprising piece of work. None of our founders could produce the like from their moulds.

In *wood* are a few things:

1. A prettily carved snuff or other mill for rubbing down dry leaves to powder. It resembles the apparatus of Brazilian Indians for the same purpose, and is not larger than the palm of the hand. A blade of hard wood, with a recess scooped in it two and a half inches one way, a little over an inch the other, and $\frac{3}{16}$ of an inch deep. The handle is the head and part of the body of an Indian, well worked out. The value put on this implement is evinced by the repairs it has undergone. The blade is cracked in three places, and each crack has been prevented from spreading by drilling holes on each side, and binding the parts together by twine or wire.

2. A spindle for making thread. It consists of a round and tapered stick, eleven inches long, and not exceeding a quarter of an inch at the thickest part. It is reduced to a point at both extremities. A little stone weight, to keep up the momentum, is fixed within an inch of one end. It is a truncated cone, the larger diameter $1\frac{1}{4}$ inch, the smaller 1 inch, and the depth $\frac{3}{4}$ of an inch. A hole drilled through the centre receives the spindle. Some broken and decayed threads remain on the rod. Altogether, the instrument might be taken for an Asiatic or European one, so similar is it to such in dimensions and construction, with one exception: there is no slit or notch at the upper end to hold the thread by.

3. A flat and thin piece of hard wood, $3\frac{3}{4}$ inches long, $1\frac{3}{8}$ inch wide, $\frac{3}{16}$ thick at the centre, and reduced thence to the sharp edges. A hole in the centre has received a small rod, like the spindle; a portion remains in it. There were dust-marks of thread round the hole, as if the rod had been charged with thread, like a spindle. The article was probably used in connexion with spinning or weaving.

4. In a little reed quiver are three red-colored sticks, six inches long, with conical ends, and precisely like those figured at No. 12, on Plate X, whose use they serve to explain. They are bolts of arrows. A quartz point was lashed to one, and those of the others had dropped off, and were found in the quiver. Rudely formed as they are, it is difficult to perceive how they were discharged, and for what purpose the conical ends served. Could they have been inserted into the ends of rods applied to the bow, and designed to separate when they reached the bird or beast shot at? Arrow-shafts composed of two pieces are not uncommon among tribes of both North and South America: but they are commonly spliced and united by thread, so as to present little or no swelling at the junction; whereas, from the enlarged ends of these, such joints were out of the question. However these bolts were used, the custom is most likely still kept up by native Indians of Peru. Captain Sitgreaves, in his report of an expedition down the Zuñi and Colorado rivers in 1853, speaking of the Mohave Indians, observes that their arms are the bow and arrow, the spear, and the club. The arrow is formed of two pieces: that to which the barb is attached is of hard wood, seven inches long, or one fourth the entire length; the other is of a light reed that grows profusely along the banks of the river, and is feathered, as usual, at the extremity.

5. Another piece of light-colored wood, streaked with a red pigment, and between seven and eight inches long. In form it resembles two long, pointed, and shallow spoon-mouths, united by a short and thick rod at their wide ends. Very roughly and laboriously cut, it furnishes evidence of the imperfection of the tools in vogue for working wood when it was formed.

6. Another, rather less, but in all other respects the same.

7. A thin tube of wood, or part of a natural reed, $6\frac{1}{2}$ inches long and $\frac{3}{8}$ of an inch bore.

8. A forked stick, the fork presenting an acute angle, like the letter V. This is manifestly the remains of a primitive adze. One branch or stump formed the handle; but it has been broken or detached by decay, a few inches only being left. The other is complete, and shows how a copper or bronze blade was secured to it; a portion of the wood is cut away, leaving a flat surface for the face of the blade, and an abutment for the head. Notches were cut in the back to receive the lashings, whose marks remain. A film of green oxide remains attached to

that part of the wood to which the metallic blade was bound. This implement, when perfect, resembled some recovered from Egyptian tombs.

9. A neatly made basket-bowl, similar in construction to Figure 9, on Plate X, but only six inches across.

8. A stone-pointed instrument, lashed by animal fibre to one side of a handle nearly two feet long. If not a weapon, it was probably an agricultural tool. The extreme point only seems to have become smooth by use.

In *pottery* the specimens are more numerous than those figured on Plate IX. There are four large vases, of which three are painted and one is plain, and in material and outline similar to Figure 3 on the plate, but more than double its capacity, being 9 inches deep and 8 across the swelled part. It has been used over a fire. The other three are about equal in capacity, though not quite so. Two have conical bottoms, and were used over a fire. They have ears, like Figure 1 of Plate IX. Below the ears they are plain and rough, because those parts were dropped into the perforated tops of their stoves, as mentioned on page 115; but all above the ears are painted, on a light-colored ground coat, with black and red designs, somewhat after the style of Figure 11 of Plate IX.

The remaining one of the four is a perfect pitcher, with a flat bottom, loop-handle at one side, but without a contracted lip. The ground color is a dark chocolate-red, upon which are displayed with considerable effect white lines, stars, and circles, relieved by others in black. The rim is ornamented inside and out. Taken altogether, the vase is worthy of a place on modern tables. The material is a light reddish clay—same as the other painted ones.

Two vases shaped like Figure 3, Plate IX—holding, the one a quart, the other not so much.

Two more—one formed like Figure 2, and the other like Figure 1, of Plate IX—might be taken for children's toys, since each could hold no more than an ordinary wine-glass.

A wide-mouth bowl, with flat bottom, and holds a pint.

A smaller one, very rudely formed, and very flat. It might have served for a lamp, if lamps were used in the family.

A very interesting specimen of ancient crockeryware is one that resembles a quart pot or tankard. It has nearly straight sides, stands four inches high, and is four in diameter. A handle, in the form of an Indian's head with a high cap or mitre, rises above the rim from swelled part of the sides. The outside of this vessel preserves rude attempts at ornament with black and brown colors. A very similar one, but slightly larger, with the head and body of a monkey for the handle, was found in a grave eleven feet under ground, near Ariquipe, during the past year, and presented to the Smithsonian Institution by Mr. Eckel, United States consul at Talcahuana, Chile. This vessel is better painted and in better preservation than the preceding.

The conical-bottomed vases having, as intimated, been used as boilers, they are furnished with stoppers formed precisely like those on Plate IX. Such as belong to painted vessels are, in like manner, ornamented over half their surfaces; a circumstance which shows that they were dropped into their places with the perforated ends up—consequently the steam never entered them.

Of *clothing,* and other woven remains, there is an apron-looking piece in tolerably good preservation—half a yard one way, and something less the other; it exhibits a pattern of fancy stripes in brown and white.

A small cap, with loop to pass under the chin. It resembles in texture the one figured on Plate X, and appears to have belonged to a child.

A coarse and open knit bag—eight inches deep and four wide.

A sling, woven in squares of black and white, in moderate preservation. Portions of the lines are missing. A variety of slings was of old in vogue in Peru. With some tribes they were the chief, with others the only weapons used in war; and considerable labor and skill were laid out on them. They were decorated in the loom, both the straps and strings being

variegated with colored threads. This specimen is a proof of the correctness of old historians on the subject. Wound round the head, they formed the only covering of the Chachapuyas.

Fragments of round, plaited cord, of brown and white strands—also bits of netting.

A handsomely wrought bag, closely woven, with fancy stripes in red, brown, and white tints.

A smaller bag, with more elaborately wrought figures in red, white, black, brown, and green colors. A row of ten pendent tassels were attached to the bottom, (most have dropped off,) making the article look very like a modern lady's reticule or work-bag.

Lastly, a *skull* in good preservation; and which, from its long plaited locks, may have belonged to the mother of the family. Perhaps within it sat the mind that contrived the useful and ornamental things just mentioned; and within it turned the eyes that watched their progressive development, from the twisting of the thread with the spindle, and imparting the various colors, to the finishing touches given to the pretty fabrics.

Besides their historic value, primitive antiquities interest us as representatives of thought, and of inventive resource, in the early conditions of our species. They show us how the arts began, and how they become modified by climate, by soil and its diverse products, and also by location—insular and continental, inland and maritime. Then they indicate, by that remarkable uniformity which pervades them (for while others differ, these are everywhere akin), a natural equality in men to invent. Let specimens be gathered from every part of the earth, and it would seem almost as philosophical to assert that animals or birds of one country were originally more ingenious than those of others, as to apply the remark to man.

Then who does not perceive in them, that to unite the ornamental with the useful is an instinct of our nature; one early evolved, and found as active in the lowest as in the highest forms of society. Where dwells the savage who adorns not his club, his paddle, and his canoe; and where the tribe that adds not colors to carving? None of the inferior beings spend labor on what is superfluous; they add nothing that is not essential. Man is by nature the only decorating animal; and hence the origin of modelling, sculpture, and painting, should not be ascribed to any one people.

With many these things have no weight, and the same may be said of society at large; still it is well to recur to what we have all sprung from, and, while contemplating the disparity between the condition of our remote progenitors and our own, to remember that we also are in a medium or transition state—one connecting the past to a future surpassing in its achievements those of the present.

But relics of American arts are of peculiar interest, inasmuch as they are connected with the solution of one of the greatest problems in human history. Here is one half of the planet without a page of written record, without legends or traditions. From its first occupancy, at a period whose date no one can tell or even conjecture, down to comparatively recent days, it presents to the historian, instead of a chronicle of dynasties, of stirring actions and mighty events, a huge and silent blank—not the name of an individual, nor the sound of a foot-fall, preserved. Comparatively speaking, it was but yesterday that the continents were discovered, and the fact of their being in possession of a peculiar race proclaimed to the rest of the world; and now, as then, there is little more information to be obtained from the Indians respecting their predecessors than from the native quadrupeds. Whatever is to be known, has to be drawn out of the ground; out of what the plough turns up; what mounds, graves, and existing earth-works may disclose, and what architectural ruins may afford. These are the only archives remaining of the deeds and destinies of the old inhabitants of the hemisphere; and hence everything registered in them, however trifling under other circumstances it might be considered, has a value proportioned to the insight it may give into national or social habits and conditions.

The American aborigines are melting away, and, apart from the moral view of the subject, there is much that is due to them. Poor themselves, they have enriched others. Besides

bequeathing to us the noblest of earthly inheritances, their contributions to the great staples of modern commerce have never been excelled. To say nothing of the fur-trade, nor of the metals, from gold and mercury to copper and lead, in unprecedented profusion, of bread plants they gave us the potato, Indian corn, and mandioca; of poultry, the turkey and other fowls; of raw materials for manufactures, India-rubber; of timber, mahogany, rose, satin, and at least two hundred other varieties of wood used in ship-building, carpentry, and for dying, furniture and ornamental wares; in medicine, Peruvian bark, jalap, and ipecacuanha. Then there is a list of plants, including tobacco, which have become necessities to such a degree that nations would stand aghast if threatened to be deprived of them.

To a people to whom we owe so much, the least that we can do is to gather up for posterity whatever memorials of them may fall in our way.

A change in terrestrial occupancy on such a scale is an episode unparalleled in the history of our globe; and though we who live during its accomplishment are in a manner indifferent to its magnitude, and to its bearings on the destinies of the species in coming times, it will be discussed and referred to in the distant future as one of ever memorable significance.

There are, moreover, ethnographical facts of marked interest to students of races and nations. For example: it is universally conceded that civilization was first developed in the East, and on the northern half of the planet, while it is uncertain whether it began here on the northern or southern side of the equator. It arose in the interior of a vast continent in one case, and apparently in the other on the shores of two oceans—Yucatan and Peru. The tropics are the base-lines of civilization. Between the parallels of 10° and 35° north arose all the historical nations of old, and with them its tendency was not so much towards as from the equator, which it never reached. It was the same with this Western world: the Mexicans and their predecessors began and limited their efforts within the latitudes of 10° and 30.° But while no ancient centre of civilization sprung up south of the line in the Eastern hemisphere, it was different here; for the earliest known southern efforts at human progress are those of the Inca dynasties, though it is uncertain whether they preceded or followed the Central American nations, whose architectural ruins yet abound.

The further information respecting ancient American civilization and arts embodied in the following pages is, from its ethnological importance, submitted in connexion with the account of kindred antiquities brought home by the Astronomical Expedition.

General Alvares, the last Spanish political chief and commandant of the province of Cuzco, made up during his administration a varied and very valuable collection of articles in terra cotta, stone, bronze, silver, gold, &c., belonging to the times of the Incas. Arriving at Rio de Janeiro (on his way to Spain), he disposed of them there. To the politeness of the purchaser—Señor Barboza, a Brazilian gentleman of great learning and of antiquarian tastes—I was indebted for opportunities fully to examine and report upon them, during a visit to Brazil in 1846. No account of them has been published till now, and it is doubtful if any modern volume contains a finer assemblage of antiquities of the kind.

A copy of the catalogue furnished by General Alvares will serve to introduce a description of the articles named in it.

(Original.)

ANTIGUIDADES DOS INCAS DO PERU.

Esta collecção de antiguidades dos Incas do Peru pertenceo ao Brigadeiro D. Antonio Maria de Alvares, chefe politico superior e commandante geral da provincia de Cuzco:

Em barro:

1. Jarro, em que se acha a cabeça do celebre Cacique *Ruminhauy*, que em classe de busto he a unica que se tene conservado desde aquella antiguide.
2. Jarro, com forma de cabeça de tigre.
3. Catimplora, com desenhos de cobras, de múi boas cores e verniz.

4. Hum jarro de quarta de altura.
5. Garrafa de verniz roxo, e alguns desenho preto.
6. Cantaro com aza, com desenhor bastante apagador.
7. Cantaro de assento plano, com aza ou orelha alta n'ella pintadas duas indias, desenho geral gachos de flores, e mariposas.
8. Cantaro com duas azas baixas, assente conico; no gargato, de realce, a cara de hum indio.
9. Cantaro igual ao anterior.
10. Cantaro igual ao antecedente.
11. Outro quasi semelhante.
12. Panela de cor verde-negro, de acento conico.
13. Panelinha menor, de acento plano.
14. Cantarinho, com riscas de cores.
15. Cantarinho, tambem pequeno, de orelha alta.
16. Dous varos iguals de cor esbranquiçada.
17. Varo igual em cores, hum ponco mais pequeno.
18. Pratinhos planos, com desenhos de flores e patos.
19. Prato fundo com bico de garça por cabo.
20. Prato de cor voxa, com a cabeça de hum passaro.
21. Outro igual.
22. Outro quasi igual.
23. Outro mais.
24. Prato com faxas amarelas, com bico e cabeça.
25. Prato com orelha.
26. Prato quasi plano interiormente.
27. Prato menor parecido com o anterior.
28. Prato pequeno, liso, com bico ou cabeça.
29. 2 Pratinhos de igual bico, com desenhos conservados em sua forma e cores, achados n'huma *guaca* n'hum povo antigo sobre o de S. Sebastian, a huma legod de Cuzco, no anno de 1820.
30. 2 Pratinhos, hum delles com aza, ambos divididos em dous quarteis brancos, e doas encamados, e em cada hum pintada huma mosca.
31. Roda com pescoço, como tampa de hum vaso.
32. Llama de madeira preta, com olhos de ouro.
33. Assobio em forma de coração.
34. Assobio em forma de hum cantaro, sem pescoço.
35. Dito, com forma de panela.
36. Roda, com dentes de roca, ou *pusca*.
37. Pratinho com cabo de bico, disenho, e moscas.
38. *Chuspa* ou saco, tecido de algodão e la de *alpacho;* no desenho se ve huma imitação de huma fileira d' indios; servia para levar a *coca*, que mascavão, e a colocavão pendente do hombro direito sobre o lado esquerdo. Foi achado em hum cadaver, no anno de 1810, no valle de Changuillo, partido de Yca, provincia de Lima.

Ouro:

1. Figura de huma india, despida com a particularidade de ser oca, de ley muito baixa.
2. Outra india, tambem despida, e maciço; ley muito baixa.
3. Hum indio despido, maciço, e de ley baixa; com transa na cabeça e dos charmados *Oregones;* na bochecha esquerda se lhe observa o *acullico*, que he estar mascando a erva *coca*.

Prata:

4. Huma india, de metal encobrado, e maciço, de 10 polegadas a duas linhas de altura, inteiormente despida, em todo o corpo, pernase braços, a cingem fachas embutidas de ouro baixo, prata pura, e champi com mescla de ouro; os olhos e as pontas dos peitos são dêste ultimo metal.

Champi:

5. Hum indio, maciço, despido, e *Oregon;* sua altura 10 polegadas e 3 linhas. Esta figura e a anterior forão achadas juntas n'huma escaração em 1818, nas immediações do povo de Limatambo, partido de Abancay, provincia de Cuzco.

Prata:

6. Hum *cacique*, com o seu trage e insignia que o representa; he maciço e com alguns adornos de ouro.
7. Huma llama do Peru, maciço.
8. Duas chapas paralelogramas, mui delgados, n'huma parte tem furos para passar fios, como adornos de pessóas mais distinctas. Acharão ve no povo de Ollantay, partido de Urubamba, provincia do Cuzco.

Champi:

9. Hum bastão de largura, tres pes duas polegados, e onze linhas, e seu pezo 7 libras e 4 onças; tem mais abaixo da grossura que figura punho, e sobre huma especie de anel, embutida do verdadeiro champi que he arroxado; insignia dos *Curacas* ou capitãos; foi achado em 1824, no povo de Orunillo, partido de Asangaro, provincia de Puno.

Bronze:

10. Grande barra, que ainda que quadrado se collocão n'hum de seus estremos: inferiormente huma especie de estrella de raios grossos, sobre esta outra igual, porem em hum dos seus raios apresenta a figura de hum machado armado; he insignia de cacique ou capitão, e foi achada no povo de Langui, partido de Pinta, provincia de Cuzco.
11. Outra estrella solta, de seis raios, igual á primeiro anterior.
12. Hum machado, que unido o ajustado a algum cabo, servia tambem de insignia.
13. Tres circulos planos, com orelha na sua estremidade, que collocavão por adorno sobre o peito.
14. Quatro alfinetes, com que prendião as roupas sobre o peito ao mulheres.

Cobre:

15. Especie de segur ou faca, com cabo do mesmo metal que imita o entransado; e no extremo sobre hum plano circular, se acha huma raposa ou gambá, levando hum filho na boca.

Bronze:

16. Assobio, em figura de tambor, embutido com champi, e sobre este dous pontos de prata.

Champi:

17. Mistura de ouro, indio e india, despidos, pequenos e mocissos.
18. Indio sentado de cocras.

Pedra:

19. De aza de mosca, hum paralelogramo, de altura de 3 polegadas e $5\frac{1}{2}$ linhas, comprimento 11 polegadas 2 linhas, e largura 6 polegadas 11 linhas; interiormente está dividido em duas ordens paralelas de quatro quadriculas, que progressiva e alternativamente se enchem de agoa ou licor; succedendo o mesmo nas quatro outras restantes, por conductos interiores que tem para o effeito; o seu desague dé huanas e outras, se acham nos seus lados oppostos, e debaixo das figuras de indio e india, que estão em relevo, e sentados; a seus lados se veem dous tigres ou gatos montezes, e esculpidas cobras que atravessam os extremos.
20. Preta, huma panela.
21. Branca, de figura triangular, pequena, que usaram como jogo da *Tava.*
22. Duas *Llamas* pequenas de distincta qualidade.
23. Duas hum ponco maiores.
24. Huma maior de trabalho grotesco.

25. Outra maior e preta mui pulida.
26. Huma de maior tamanho, bem trabalhada, que figura o animal chamado o *alpacho*.
27. Outra maior, jaspeada mindamente de roxo e branco.
28. Almofariz, cor roxa, com azas.
29. Mão de almofariz sobre a qual se acha hum gato montez.
30. Figura de hum urso.
31. Duas pretas larradas que arrojarão nas fundas.
32. Duas de metal *soroche*, para atirar nas fundas.
33. Especie de colher de pedreiro, em forma de ferro de engomar, de que se servião para reboca com barro os seus edificios.

Prata:

34. Huma pequena llama mocissa, carregada com duas barras; huma de prata e outra d'ouro encobrado.

Bronze:

35. Meio corpo de hum indio *Oregon*, corcovado, com o *acullico* dentro da boca, despido, e com o *llauto* na cabeça.

Champi:

36. Hum assobio, formando a cabeça de indio; seu *acullico*, e barrete de forma conica truncada com embutido de cobre em formo de grega.

Bronze:

37. Hum assobio piramidal de seis faces, embutido de cobre, e em duas d'ellas oppostas, com prata figurando cobras.
38. Hum assobio com a figura do animal conhuido *quinquincho*.

Cobre:

39. Huma pinça, que punhão por adorno no peito.
40. Hum cascavel, cuja aza difere dos communs; foi achado estramuros de Cuzco, em huma escavação no anno de 1821.

Concha:

41. Dous pedaços larrados e furados, hum vermelho, e outro esmaralado na sua extensão, penduravão, os como adorno, forão achados em Cuzco n'outra escavação no anno de 1820.

Pedra:

42. Hum almofariz de cor parda, figura oval.
43. Outro pardo com lineamentos roxos, de quasi igual figura.
44. Outro, como para saleiro, de figura paralelogramica, cor verde parecida com a malaquito.
45. Hum *alpacho*, côr roxa.
46. Outro de cor preta esverdiada.
47. Huma *llama* com o principio dos pes, ajunas, cor de barro.
48. Huma esverdiada.
49. Huma metade preta, e metade de cor parda clara.
50. Huma parda.
51. Huma menor amaralada.
52. Huma branca cristalina e transparente.
53. Huma menor preta, com manchas verd e escuras.

(Translation by an English officer in the Brazilian army.)

Antiquities of Peru.

This collection of Peruvian antiquities belonged to Brigadier General Don Antonio Maria de Alvares, superior political chief and general commandant of the province of Cuzco:

Terra cotta:

1. A pitcher which represents the head of the celebrated cacique, Ruminhauy. Of the class of ancient portrait vases it is supposed to be the only one extant.
2. Another in the form of a tiger's head.
3. A bottle, with snakes painted on it—very vivid colors.
4. A pitcher, of the capacity of a quart.
5. A bottle painted with bright color and varnish, and black paintings or designs.
6. A vase with handles, and ornamental designs nearly obliterated.
7. Ditto, flat bottom, decorated with the figures of two Indian females, stems of flowers, and butterflies.
8. Ditto, with two low handles and conical bottom. An Indian's face is moulded on the upper part.
9. Another of a similar character.
10. Ditto, ditto.
11. Ditto, ditto.
12. A pot of a black-green color and conical bottom.
13. A smaller pot, flat bottomed.
14. A small water-pot, with painted stripes of different colors.
15. Ditto, with high handle.
16. Two ditto of a whitish tint.
17. One ditto, a little smaller.
18. Small dishes or plates, with figures of flowers and ducks.
19. A deep plate, with the handle in the form of a heron.
20. A plate of a violet color, with the head of a bird for the handle.
21. Another, of a similar character.
22. Another, nearly the same.
23. Another, ditto.
24. A plate with yellow wreath, and a bird's bill and head for a handle.
25. Ditto, ditto.
26. Ditto, nearly flat.
27. Ditto, ditto.
28. Ditto, small, smooth, and flat.
29. Two small plates, with ornamental designs preserved in form and colors. They were found in a *huaca* in an ancient dwelling near Saint Sebastian, one league from Cuzco, in the year 1820.
30. Two small plates, one with a bird's head handle: each divided into two white-painted quarters, and two red, and in each (quarter) is painted a fly.
31. A disc, with a neck similar to the cover of a pot.
32. A llama of wood, black, with gold eyes.
33. A whistle, in the form of a heart.
34. Ditto, resembling a vase.
35. Ditto, resembling a pipkin.
36. A wheel, with teeth of ———, or *pusca*.
37. A small plate, with the handle in the form of a bird's head.

38. A *chuspa*, or bag: the weft of cotton, and the warp of the wool of the *alpacho*. The ornamental figures are intended to represent a file of Indians. The bag was used to carry the herb *coca*, and worn suspended from the right shoulder at the left side. It was found on the skeleton of an Indian, in the year 1810, in the valley of Changuillo, district of Yca, province of Lima.

Gold:

1. A naked female figure, and hollow.
2. Another, but solid.
3. A male Indian, naked, solid, with the hair of the head plaited. This is one of those named *Oregons*, or long-eared; in the left cheek is observed the *acullico*, a ball of the herb *coca*.

Silver:

4. An Indian female of gilt metal, solid, 10 inches 2 lines high, naked; body, legs, and arms bound with rings of low gold, and pure silver and champi, mixed with gold; the eyes and points of the breast are of gold.

Champi:

5. A naked Indian, solid, an *Oregon*, 10 inches 3 lines high. This figure and the preceding one were found in an excavation, in the year 1818, in the neighborhood of *Limatambo*, district of Abancay, province of Cuzco.

Silver:

6. A cacique with dress and insignia, and solid decorations of gold.
7. A llama, solid.
8. Two plates, very thin; in one part are small orifices to pass threads; supposed to have belonged to persons of quality. Found at the village of Ollantay, district of Urubamba, province of Cuzco.

Champi:

9. A staff, 3 feet 2 inches 11 lines wide, weighing 7 lbs. 4 oz. It has below the thicker part, shaped for the hand, a ring inlaid with pure champi, which is of a velvet color. It is an insignia of the *Curacas* or captains. Found in 1824, in the valley of Ormillo, district of Asangaro, province of Puno.

Bronze:

10. A metallic battle-axe or mace, with six rays, one of which forms a hatchet. It is an insignia of a cacique, and was found in the village of Langui, district of Tinta, province of Cuzco.
11. A star of same metal, with six rays, similar to the former.
12. An axe; which, when united to a handle, was a token of dignity.
13. Three flat circles, with an ear at one edge—an adornment for the breast.
14. Four pins, used by females for securing their dresses.

Copper:

15. A kind of *segur*, or knife, with handle of same metal, in imitation of plaiting. Upon the handle is a fox or gambá, with a young one in its mouth.

Bronze:

16. A whistle, in the form of a drum, adorned with champi, and two silver points.

Champi:

17. Male and female Indians, naked; a mixture of gold and silver, solid, and small.
18. An Indian, in sitting posture, with his legs crossed under him.

Stone:

19. A parallelogram of "*aza de mosca*" (fly's wing), 3 inches 5½ lines high, 11 inches 2 lines long, 6 inches 11 lines wide, divided in the interior in two sets of four receptacles each, which communicate with each other. Their contents are discharged on opposite sides, underneath figures of a male and female Indian, in high relief, and sitting posture, on each side of which is a tiger or mountain-cat, and on the end snakes are sculptured.
20. A black pot.
21. A white pot, of triangular form, used at the game of Tava.
22. Two llamas, small distinct species.
23. Two ditto, rather larger.
24. One ditto, still larger, grotesque workmanship.
25. One ditto, ditto, black and polished.
26. One still larger well-wrought figure of the *alpaca*.
27. One ditto, jaspered minutely, violet and white color.
28. A mortar, violet color, with handles.
29. A pestle, with the figure of a mountain-cat at the extremity.
30. A bear.
31. Two black stones, used in slings.
32. Two of the metal *sorochc*, to use in slings.
33. A mason's trowel, form of a smoothing-iron, to lay on plaster in buildings.

Silver:

34. A small llama, solid, laden with two bars—one of gold, the other of silver.

Bronze:

35. Half body of an Indian, an *Orcgon*, in a stooping posture, with the *acullico* in the mouth, naked, and with the *llautu* on the head.
36. A whistle, formed after the head of an Indian, with the *acullico* and a cap inlaid with copper—Grecian form.
37. A pyramidal whistle of six faces or sides; inlaid with copper, and on two opposite sides with silver snakes.
38. A whistle, in the form of the animal *quinquincho*.

Copper:

39. An ornament for the breast.
40. A varvel, found by the walls of Cuzco, in an excavation in 1821.

Shell:

41. Two pieces of shell, chased and bored—one reddish, the other yellow—used as ornaments. They were found in the city of Cuzco, during an excavation in 1820.

Stone:

42. A mortar, of a brown color, oval shape.
43. Another, similar shape, with violet stripes.
44. Another, form of a salt-cellar, shaped as a parallelogram, green color.
45. An *alpaca*, violet color.
46. Another, black-green color.
47. A llama, with feet and legs clay color.
48. Ditto, greenish color.
49. Ditto, half black, half light-brown color.
50. Ditto, brown or clay color.
51. A llama, smaller in size, yellowish color.

52. Ditto, white and transparent (crystalline).
53. Ditto, lesser size, black, with dark-green spots.

Earthenware.

For the purposes of classification and description, the articles are arranged in groups, according to the principal material in each, while the accompanying illustrations may be viewed as so many pattern-cards of pottery, stoneware, hardware, works in silver, gold, and *champi*, (said to be an alloy of copper and gold, or of copper and silver).

The first figure, *a*, is of special interest, from its historical associations, and the light it reflects upon one of the modes by which Peruvians perpetuated the features and characters of prominent men. A drinking-vessel of a reddish clay, it stands nine inches high, has an internal depth of six inches, and is two inches across the mouth. It belongs to a class of vessels of which, it is supposed, there are not over two or three extant, viz: vase-busts. It represents the head of the famous Cacique *Ruminhauy*. The features are strongly developed, and with indisputable traits of an individual's portrait. A deep wound is shown on the right cheek; the eyes and upper teeth are prominent; a front tooth is left out, and the place for it distinctly marked. The hair is dressed in plaited cords. The ears are small, unpierced, and well modelled,

the upper lobes being level with the under eyelids. The border of the tire or head-dress is handsomely notched in front and twisted behind. The round base, as well as the rest, was modelled by hand, and by the hand of an expert, too. It will be remembered that in the Old World baked clay busts and relievos preceded marble statuary.

Instead of carousing, like the savage Scandinavians, and others professing more refinement, from the skulls of the conquered, the Peruvians employed these harmless imitations, and anticipated a branch of art which modern potters might usefully extend much farther than they have yet attempted.

Ruminhauy, or Rumminaui, stands out in horrid relief in the Commentaries of Garcilasso de la Vega. After the death of Atahualpa, he schemed to succeed him. With this view he invited the brother of the murdered Inca, his sons and daughters, and some chiefs whom he could not rely on, to a feast, at which he introduced, besides the ordinary drinks, a spirituous liquor named *sora*. His object was accomplished. His guests indulged in it, became intoxicated and helpless, and he slew them. He covered a drum with the skin of Atahualpa's brother, leaving the scalp hanging to it. He subsequently buried alive a number of females, old and young, under circumstances of unusual barbarity. "Thus did this barbarous tyrant discover more unhumane cruelty and relentless bowels by this murther committed on poor silly women, who knew nothing but how to spin and weave, than by his bloody treachery practised on stout soldiers and martial men. And what further aggravates his crime was, that he was there present to see the execution of his detestable sentence, being more pleased with the objects of his cruelty, and his eyes more delighted with the sad and dismal sight of so many perishing virgins, than with any other prospect. * * * * * Thus ended these poor virgins, dying only for a little feigned laughter, which transported the tyrant beyond his senses. But this villany passed not unpunished, for after many other outrages he had committed during the time of his rebellion against the Spaniards, and after some skirmishes with Sebastian Belalcaçar (who was sent to suppress him, as we shall hereafter relate), and after he had found by experience that he was neither able to resist the Spaniards, nor yet, by reason of his detestable cruelties, to live amongst the Indians, he was forced to retire with his family to the mountains of *Antis*, where he suffered the fate of other tyrannical usurpers, and then most miserably perished."—"Royal Commentaries," *translated by Ricault, Book II, Chapters* 3 *and* 4.

The second figure, marked *b*, has been modelled after the head of the Jaguar. It is of a darker red than the preceding, and is ornamented with black lines and spots. The tongue protrudes. There are two openings into this vessel—one at the left ear, through which it was charged, and a small one at the back, near the bottom, to draw off the contents. The substance is encreased round the last, to afford hold of a wooden plug. Capacity of the vase, three pints.

Figure c is another red vase, and one whose form and ornaments indicate good taste in the artist, whoever he was. On the opposite side the remains of a painted panel are visible, and within it the figures marked *c'*. The handles have been elaborately adorned, also, with a black pencil. The diameter of this vessel does not exceed five inches, and its depth is only one and three quarters. It appears to have been used over the fire, although painted vessels, it is supposed, were not generally used as sauce-pans or skillets. They were probably placed over perforations in the stone slabs of old Peruvian stoves.

Figures d, d', are front and edge views of a flat bottle, eight inches in diameter and a little over three inches in thickness. Of a bright red, the upper half is ornamented with black, white, greenish, and purple lines (not shown in the figure). Two cobras, or double-headed snakes, are on each side, and below a white band. Two crosses are cut into the material.

The vase *e* is only four and a half inches deep, and three across the lips. It is ornamented all round, but less on the side represented. It has three features characteristic of vessels carried about the person: loops to sling it by, a conical bottom, and a stud projecting from the swell equidistant from each loop. Whatever was the object of these studs, they seem to have been carried next the person, since they are always found on the plain or least decorated sides of

vases. Besides the loops, a couple of small holes are made in ears close to the rim, as if to pass twine through.

The vase *f* is three inches deep, and four and a half in diameter at the widest part; flat bottomed and with transverse handles, as in figure *e*, instead of vertical loops; it has evidently been employed in heating liquids: marks of fire are perceptible. Most of the colored ornaments are gone.

Figure g, a beautifully formed vase. The stud is colored white, and the panel is drawn in black on the usual pale red surface. The capacity about three pints.

Figure h is somewhat smaller, of the same general outlines, but differing in colored ornaments. The stud on its side is round, while on the rest it is square.

Figure i, a square bottle of the same material as all the preceding. It is seven inches high, and four across each side. The top is flat, projects a little all round, and more so at the corners. The contents were poured in at the top, and drawn out at the small opening near the bottom. Both openings are protected by raised borders. This vase, so like those in modern liquor cases, (the second figure *b*, and probably others), was certainly not designed to hold water, but for keeping more precious liquids, and spirituous liquors in all probability. That the Peruvians had such is well known. Acosta says of one, that it induced intoxication much quicker than wine; and the strength of *sora* was such as almost instantly to prostrate those that indulged in it. Its use was prohibited by several of the Incas, under the penalty of death.

Figures j, j' are front and end views of a vase in the form of a shield, of very small dimensions, possibly a child's flask. A loop is moulded on one side by which to suspend it.

Figure k, a minute bottle, rather roughly formed, decorated with lines sunk in the surface. Its material inclines to gray rather than red.

Figure l, a travelling vase. The face is well brought out, and the whole elaborately painted. Its capacity does not exceed a pint.

Figure m, a larger one, holding near two quarts, and elaborately ornamented.

Figure n. This vessel would hold a pint and a half. It is of a yellowish clay, and has been profusely embellished; but except traces of the pencil here and there, all is obliterated. The lip has a recess to receive a plug. This bottle is supposed to be the oldest in the collection.

Figure o, a minute pitcher, but prettily embellished in black and yellow. Having a rounded and convex bottom, it was necessarily suspended by the handle when not in use.

Figure p, another bottle with a flat bottom, nearly five inches in diameter, and of the same height, neck included. The front part has been tastefully painted, and the large handle also. The weight scarcely exceeds a quarter of a pound.

Figure q, a long-necked bottle without a handle, and designed for a traveller, as the loops and stud declare. The opposite side is decorated—the one shown is left plain. This vase is nearly eight inches high, of which the neck makes four inches. At the swell it is four and a half inches in diameter.

Figure r, a drinking-cup not quite four inches high. The diameter at top is rather less, and at bottom two inches. A golden cup in the possession of Señor Barboza, from the tomb of an Inca, is of precisely the same figure, but less than half the size, and raised without solder from a flat piece of exceedingly thin metal.

Figures s, t, u, v, w, x, y, are specimens of thirteen plates or shallow pipkins (or whatever their proper designation may be), varying from three to thirteen inches across, and rarely exceeding half an inch in depth. Most of them have handles, terminating with the head of a bird, &c. All are ornamented within, none without. The colors are black, red, white, and yellow—the last looking like unburnished gold. Except such as have recurved or ring-shaped handles, all have studs at the rims; and some of these projections have small perforations, probably to insert loops of twine to suspend them against the walls, instead of resting them on shelves. Those marked *s, t*, were found in 1820, in a huaca near Saint Sebastian, one league from Cuzco.

Figures z and *a* 1 are of stone-like texture, their capacity scarcely exceeding that of thimbles. The first is only an inch high; and the second one and a half, and two across the bottom. Could they have been lamps?

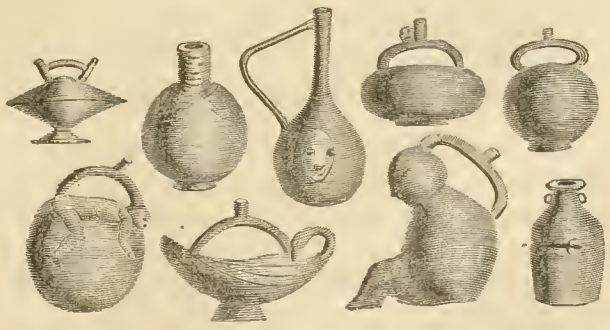
Figure a 3, a pot or crucible cover; a fox's head imitated on the handle.

To this ancient pottery I have added a modern Peruvian specimen, *a* 2, a small vase in my possession. Its material, a red clay, is similar to that of the preceding. Particles of mica are seen in both. It is rudely formed, ill burnt, and the ornamental work immeasurably worse done than what the old potters turned out.

There were a few other small matters intended for the preceding group of figures, but which have been accidentally omitted. One was a whistle formed in the body of a small bird of baked clay. The relic was very old, and the head missing. The tone was shrill and clear, and was pleasantly modified by partially or wholly closing with the finger an opening in the breast. There were also two whistles of cocoa-wood; one gave a triple sound, and was little larger than a thimble.

On casting a parting glance over this graphic invoice of pottery, and bearing in mind that only samples of the plates and saucers are inserted, it may appear surprising to some persons that such numbers of fragile articles should have reached us, and without being damaged, after passing through dark, turbulent, and indefinite periods of time. But there is something which explains that, and is stranger, viz: that our knowledge of those who owned them should be derived from their ignorance. By a superstition indigenous to all lands, people without records have left their annals in their graves. In the belief that their wants and occupations would be the same in the spirit land as they were here, they had their household and personal effects interred with them. Every Inca had his cooking utensils in his cemetery; not only his gold and silver ware, but, observes the native historian, "the plates and dishes of his kitchen." We can scarcely regret the prevalence of a delusion which has been the means of making us acquainted with the arts and habits of peoples, of whom we could otherwise have known little, and posterity nothing—that is, by our making a proper use in this life of things which they foolishly laid up for another. Indeed, those things seem intended by Providence as agents for preserving a knowledge of the successive stages of human progress till barbarism is no more.

Before passing to other matters, the following little group of ancient Peruvian pottery may as well be introduced, although not included in the catalogue. It contains specimens only of a large collection in the private cabinet of the Emperor of Brazil, which is also rich in Eastern antiquities, including objects in bronze from Pompeii and Herculaneum. The whole is open to visitors; for, as a lover of science, as well as a gentleman of the purest morals, Pedro II stands pre-eminent in the house of Braganza. Most of the vessels were ornamented in colors or relief.



Ancient Peruvian Pottery.

The first figure at the left, on the upper row, represents a small water-pot. It is almost a facsimile of one lately taken from an ancient tomb and presented to the Hon. Henry A. Wise. In

its two spouts of different sizes—one through which to fill it, and the other to drink from—and in its bail or handle, it resembles the popular "Monkey" or "Pitcher of Brazil," an aboriginal vessel of universal use in that country, and which has been dug up in Chile, Peru, and other parts of South America, in diversified forms and dimensions, plain and ornamented. It is worth remarking that similar vessels have been found in the catacombs of Rome.

The next vase, if placed in a collection of Egyptian relics, would be received as a genuine canopus, so striking is its resemblance to some Pharaonic vessels.

The third figure is a long-necked bottle, moulded at opposite sides into protrnding fish-heads.

The fourth is in the form of a spheroid, with the neck united to it by two curved tubes; a feature common in old water-flasks of Meridional America.

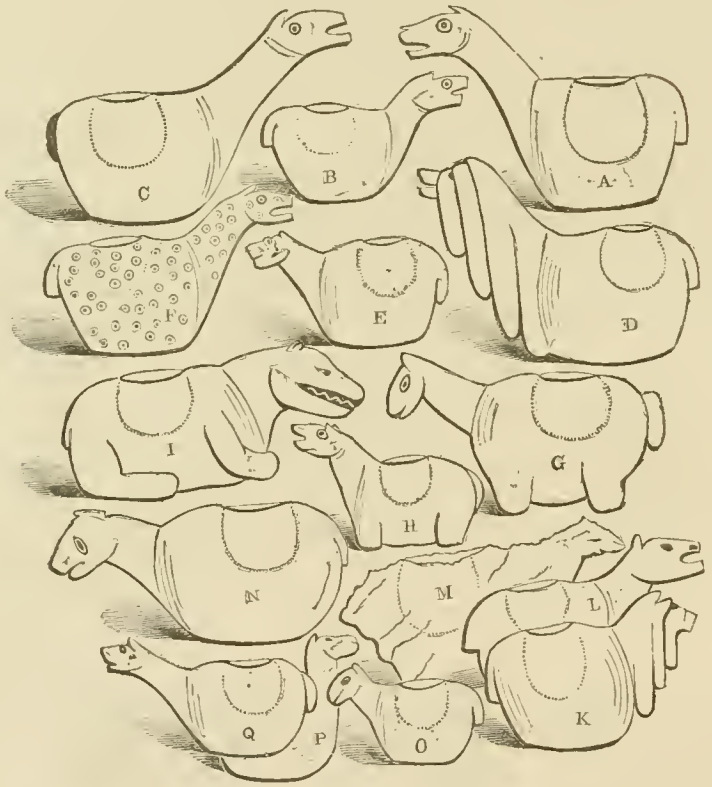
The fifth is another, elaborately decorated with colors.

Of the second row, the first is very like two antique Bolivian bottles, engraved in *L'Homme Americain*, Paris, 1839.

Of the two next, one is figured after a bird; the other, after a man in a sitting or bent position.

The last is a neat bottle, with loops for a cord to suspend it. A lizard has been painted on it between two bands—(omitted by the engraver.)

Utensils in Stone and Wood.



I have here thrown together in outline a number of utensils whose use is not ascertained. All, save one, are carved in stone, and, with a single exception, modelled after the Llama and its relatives—the Alpaca, Guanaco, and Vicuna. It is difficult to imagine them anything else than mortars, or salt-cellars. The cavities are represented by dotted lines. The bottoms of all are flat, and hence they were evidently designed to stand alone, and to be used in the positions in which they are figured. There were *twenty-one* in the collection. Those omitted presented no peculiar features.

The first one, marked C, is the largest, being six and a half inches long and four inches deep.

It is of gray basalt. The cavity is two inches deep, and three-fourths of one inch in diameter at the top, but rather wider below. The whole is well polished and the surface mottled.

Figure B is three inches long, one and a half deep, and as wide across the body; the cavity one inch by three quarters. The stone is veined, and of a yellow tint, inclining to green. It is jasper.

Figure A. Polished schistus; the upper half black, and the under a palish yellow. The body two inches long, and not quite so deep. (It is drawn too large.)

Figures D and K. Both of schist; the former, black—the latter, darkish brown.

Figure E, of alabaster; the cavity in it is less than an inch in depth, and not quite half an inch in diameter.

Figure F is schist, or soapstone; surface black, and covered with rings scratched on it with dots in their centres.

Figures G, H, L, O, P, Q, of various stones, two of steatite; and the rest as easily cut, except one of granite. Their dimensions vary but slightly from those already given.

Figure I, a calcareous stone, wrought in imitation of a bear or hippopotamus. The resemblance to the latter is the greatest; but the difficulty is, how ancient Peruvians could obtain a knowledge of that animal.

Figure N is of hard *wood*, four and a half inches long, and two inches deep. The eyes are plugs of *gold*, of the form and position represented.

Figure M is one of a couple whose lineaments have become almost entirely destroyed by time.

The Peruvians used tobacco in the form of snuff. They also prepared the leaves of the coco and other plants for medical purposes by grinding; hence the demand for small mortars.

An extract from Von Tschudi will add to the interest of these relics:

"Under the dynasty of the Incas, when any useful plant and animal was an object of veneration, the Peruvians rendered almost divine worship to the llama and his relatives, which exclusively furnished them with wool for clothing, and with flesh for food. The temples were adorned with large figures of these animals, made of gold and silver; and their forms were represented in domestic utensils of stone and clay. In the valuable collection of B. C. Von Hägel, of Vienna, there are *four* of these vessels, composed of porphyry, basalt, and granite, representing the four species, viz: the llama, alpaca, guanaco, and vicuna. These antiquities are exceedingly scarce, and when I was in Peru I was unable to obtain any of them. How the ancient Peruvians, without the aid of iron tools, were able to carve stone so beautifully, is inconceivable."

In the report of the recent exploration of the Valley of the Amazon, under the direction of the Secretary of the Navy, by Lieutenants Herndon and Gibbon, Part II, are engravings of three of those stone utensils, from private collections in Cuzco. Lieutenant Gibbon observes, that the proprietors of antiquities in that city prized them very highly, and can seldom be induced to part with one, but, on the contrary, are anxious to receive anything in addition.

In the following group, (see engraving on next page,) the first figure, A, represents a small and neatly cut stone vessel, supposed to have been designed for triturating purposes; but its flat bottom and the absence of hardness in the material, point rather to culinary operations. I think it was used over the fire, or on the flat covers of the cooking furnaces already alluded to. It is only four inches in diameter, one and a half inches in depth without, and one inch within.

Figure B is a pestle, of hard and finely-grained granite, and black with age. A wild cat, or panther, is sculptured on the upper part, and forms a not inconvenient handle. It indicates taste in conception and skill in execution. The height of the instrument is five inches; diameter of the lower part one and three quarters.

Figure C, a round, black and exceedingly hard stone, regularly formed as in a lathe, is nearly seven inches in diameter, and three and a half inches deep. It is a mortar; the cavity, indicated by the dotted lines, is four and a half inches across, and two and a quarter deep. It was not found with the pestle B, which appears to have been designed for one much larger.

Figures D, D′, a view and section of a silversmith's crucible. E is another. They might be

taken for small mortars. One was of clay, the other of a species of soapstone. Neither exceeded two inches in depth or diameter.

Implements and Utensils in Stone.

I am not aware of any large sized ancient crucibles having been recovered; yet it is evident the old founders had them, since they turned out castings of several hundred pounds weight. Examples abound in the early historians. Gomarra mentions basins in a bath belonging to Atabalipa, "one of which weighed eight arrobas of gold, which makes two hundred weight English." In a vault at Cuzco "an entire sepulchre [coffin] of silver was dug up, so thick and massive that it was worth fifty thousand pieces of eight." A vessel of gold was accidentally found, and it weighed between two and three hundred pounds; "for the Indians make greater or less of these as occasion requires, using them *to boil drink or liquors in.*" Now, as they had no bellows, it may be asked, how such masses of metal were fused? Garcilasso states that in reducing silver from the ore, "they melted it down in *earthen or clay pots*, which they carried from place to place;" and that, instead of bellows, they used blow-pipes "made of copper and about a yard long, the ends of which were narrowed that the breath might pass more forcibly by means of the contraction; and as the fire was to be more or less, so accordingly they used ten or twelve of these pipes at once, *as the quantity of metal did require.* And still they continue this way, though the invention of bellows much more easier and forcibly raises the fire."

The instrument represented at F F', I naturally enough took for a smoothing-iron, or an old American substitute for that indispensable implement of our laundresses, but I was greatly mistaken. It is an ancient plasterer's trowel, cut out of one stone, handle and all. Its dimensions are those of the common sad-iron; the face being four inches by three and a half, and a little over half an inch thick. It is pretty well scratched by use.

This is another of those coincidences of thought in inventors, far separated from each other by distance or by time. Indeed, every discovery of new lands and strange people has shown the uniformity of human efforts at mental and material civilization, a result that has frequently

excited surprise, but which ought not, since it is unavoidable, being due not less to the earth herself and the laws impressed on her materials, than to man's organic structure. There are no mechanical, chemical, or other principles provided for one part of the globe, or for one race of men, to the exclusion of others; and hence, wherever invoked, feebly or with power, their manifestations must be more or less alike. To smooth the interior surfaces of the walls of dwellings with a coating of plaster or clay was an instinctive suggestion, and coeval with it was the idea of the plasterer's trowel, in one or more of its forms. From the remains of smooth and polished walls in Peru, Central America, and Mexico, it is probable that a finer finishing instrument than this stone one was employed—most likely one of copper or silver: modern plasterers use trowels of wood, and polish with blades of steel.

Figure G, a black, hard, and smoothly polished stone, resembling an egg in shape, used for working their sheet-metal. H is another "hollowing hammer" of iron-stone, and one that might be employed with advantage by our tin, copper, and silver smiths. The groove worked round the middle was the universal device by which handles were secured to primeval stone axes, hammers, and chisels, viz: by bending a hazel or other pliable rod twice round the indentation, and then twisting or lashing the two ends together, to serve as a handle. Blacksmiths to this day everywhere thus handle their punches and chisels. They have discovered no mode superior to one which was in vogue before edge-tools of metal were known. To have inserted the handle into G or H, would have rendered it exceedingly liable to fracture at the opening, whereas its durability is all but unlimited when hafted as H was.

Figure I, a box two inches long, one deep, and seven-eighths wide, cut out of a soft, greenish tinted stone. A Peruvian Indian in Rio, from Cuzco, says it was a salt-box.

Figure J, an axe, or hatchet, two inches deep, and two wide at the blade, which is brought to a fine edge. The stone, though well polished, is not hard. It is only two inches deep, and the same across the edge.

K. A box or chest, divided into eight equal compartments. It is two and three quarter inches long, two and a half deep, and six and a quarter wide. The material is a stone known as "Aza de Mosca," Fly's Wing. At the ends serpents are figured, and at the sides a man and woman in high relief in a sitting posture. At their feet the liquid contents were drawn out at two orifices, to which plugs or faucets were adapted. On each side a couple of tigers are sculptured, whose heads and protruded tongues stand out full an inch—their bodies being in low relief. For the sake of the head-dresses, the human figures—supposed to represent an Inca and his wife—are enlarged and figured separately at L M.

The object of this vessel is not obvious, except that it was for mixing liquids, but whether for innocent or deceptive purposes does not appear. A plan of it is below at K′, showing channels of communication between the partitions at the bottom and along the sides. These do not exceed one fourth of an inch bore. They have been cut too large in the engraving. From a slight examination it will be perceived that the contents of cells 1, 6, 8, 3, were discharged at one orifice, while those of 2, 5, 4, 7, ran out at the other. The material of this vessel is of a uniform grayish-black color, and not very hard—almost as easily cut as soapstone. The corner and two side channels of communication are formed in plaster or cement, with a species of covered-way on those parts of the bottom.

Works in Bronze.

Next in interest to a personal interview with half a dozen ancient Peruvian founders—could they be called up from the dead to hold communion with us—would be a daguerreotype picture of them in the midst of their implements and processes; and next to that are opportunities of examining articles produced by them, with more or less of the tools they employed. The information thus obtained is reliable, as far as it goes; and as metallic antiques accumulate, so will our knowledge of their authors, until we shall be in possession of details of their fabrication.

All the articles in the following group have been cast, and some are remarkable specimens of casting.

Figure A 1, a staff of solid bronze, whose length did not agree with that given in the catalogue. It was two feet and a half long, (English measure,) exclusive of the wild-cat on the end of the handle. See this end enlarged at R. The part grasped by the hand was six inches long and nearly an inch and a half thick. Two crosses were sunk deep in it, one opposite the other, and between them two other indentations of the figure of R′. The handle terminates below in a handsome bulge or swell, inlaid with net-work of silver or a silver alloy. The rest being plain and tapered, requires no notice. The composition, though designated as *champi*, appeared very similar to the bronze instruments figured on Plate VIII. The cord by which the staff was slung over the arm or secured to the wrist remained attached: it passed between the feet of the animal. The entire instrument was one casting—the wild-cat included.

Implements in Copper and Bronze.

Three kinds of official batons or sceptres have been found, viz: in gold, silver, and bronze—supposed to have been borne respectively by Incas, Curacas, and Caciques—a classification that awards the one described to a chieftain of the latter class. The crosses cast in the handle recall those met with by the early discoverers, to account for which the legend of St. Thomas preaching in America was introduced. As a mythic symbol, the figure is known to be more ancient than Christianity, both in the East and the West. Whether employed as one by the aborigines of the South, Garcilasso was uncertain. He describes a cross of jasper or marble, suspended by a *golden chain*, in the Inca's apartments at Cuzco, and much esteemed. The Spaniards seized it; and when he left his native city for Europe, (in 1560,) it was hanging by a *ribbon* in the vestry of the cathedral church. It was only a few fingers' breadth in size, and in form resembled that figured at R—the transverse bar being equal to and running across the middle of the upright one.

The three circular plates, A, D, H, are respectively three, three and a half, and four inches in diameter, and vary from $\frac{1}{16}$ to $\frac{3}{16}$ of an inch in thickness. They are slightly concave on one side, and convex on the other. Two are of copper, and one of bronze. The difference is perceptible in their weight—the alloyed one being, of course, the lightest. One is so covered with rust as to resemble iron. I took them for mirrors; but they do not seem to have been polished. In the catalogue they are named breastplates. They are cast; and marks, when the flasks or two halves of the moulds met, are visible in the holes by which they were suspended.

F, is one of two plates of silver, two and a half inches by one and a half. They were thin, uniform in thickness, and appeared to have been hardened, either with the hammer or an alloy. The edges of one were as sharply defined as if they had been cut with shears, which Garcilasso and other writers state were wholly unknown until introduced by the Spaniards.

B, C, E, G, are bronze hair or dress pins. E, the most perfect, is four inches long, with a solid head and a rude wire ring *soldered* to the shank with *silver solder*—the first marked example of hard soldering I have met with among old American metal wares. The joints of the moulds are visible on it, as in others; for the whole were cast, the holes included.

I, a knife, resembling in its general outlines the one figured on Plate VIII. A cylindrical haft three inches long, and not quite half an inch thick, connects the curved blade with a disc or button, on which a fox or *gamba* is mounted, with a prey or young one in its mouth. The surface of the haft is dented, to imitate a cord, or something like the plaited covering of a whip handle. In this particular, the engraving does not do it justice. The blade is half an inch deep, and not quite one-eighth of an inch thick at the back. There is positively no soldering—the whole having been cast complete. The alloy is a low one of copper and tin. It approaches, though it does not reach, the composition known as gun-metal, whose ingredients for small articles are, an ounce and a half of tin to a pound of copper, or about 10 per cent. The edge was rather easily cut by a penknife, and yet I think it was harder than gun-metal; but the difference, if any, in this respect, is satisfactorily accounted for by the well-known impurity of South American copper and tin. Both have to be refined before being used by European and American manufacturers. The former is believed to contain iron.

This was clearly the common form of the old Peruvian knife, for numbers have been found, all bearing the same general outlines. I have lately seen two, recently brought from Peru, which approach still nearer to the cutting instrument of saddlers—the hafts being equi-distant from the ends of the blades, and the edges curved uniformly. The blade of one is two inches long, three-fourths of an inch wide in the middle, and at the back is a little over $\frac{1}{16}$ of an inch thick; the haft is imperfectly cylindrical, an inch long and $\frac{3}{16}$ thick, with the head of a llama at the end, and has a small ring for a thread, to suspend it over the wearer's neck.

J, K. Two views of the same thing—a minute bell, three-fourths of an inch in its longest diameter, with the triangular shank one inch and three-eighths high; rude in fabrication and much corroded, and consequently its sonorous property very weak. A shapeless hole is in the upper part, from the metal not having been sufficiently fluid at the time of casting. A loose pebble of copper is within and forms the clapper. This interesting article was disinterred near Cuzco in 1821. Hawks' bells, we know, were among the chief presents by which Columbus gratified the Indians of the Antilles; but it is not the less true that the brass-founders on the Pacific possessed the art of making similar things, and this certainly might have been inferred from their familiarity in mixing the ingredients. They had but to double the proportion of tin used in the compounds of which their edge-tools were made.

L. An axe or chopper, four inches deep and three wide at the cutting edge, which is well formed and sharp. It has been used as a chisel, for the upper surface is partly spread out by blows, probably from a wooden mallet. The extension of the head on either side was most likely designed to serve as handles when thus employed. Though harder than copper, the edge yielded readily to a penknife.

N. The bronze head of a war-club, or six-pointed mace; one of three discovered in a grave in the province of Cuzco. Two are in fine preservation, but this is somewhat corroded. The extreme diameter between two opposite rays is nearly four inches. The hole for the handle is of one inch and an eighth bore, and slightly tapers; its depth is one inch and a quarter. A collar is cast on the side towards the handle. (See the section N′.)

M has one of the rays lengthened and formed into a hatchet or war-axe, the blade of which equals in hardness I and L. The rays are narrower than those of N. The side-view, on a smaller scale, in the middle of the group, represents the same instrument. The third specimen I have not thought it necessary to sketch. It resembled N; the rays were a little longer, and not so thick. Though less in volume than either N or M, it was heavier and softer, being nearly pure copper. It showed marks of hammering over its entire surface.

It will be remembered that weapons identical with these are mentioned, by old historians, among arms stored for public emergencies during the sway of the Incas. "Pikes, (says Garcilasso,) clubs, halberts, and pole-axes, made of silver, copper, and some of gold, having sharp points, and some hardened by the fire." (Book I, chapter 8.) Carpenters, he observes, had axes and hatchets of copper, and the sculptors cut stone with flints and hard pebbles ground to an edge. (B. II, c. 16.)

Blas Valera, one of the earliest Spanish writers, remarks that the copper which the natives called *anta*, served them in the place of iron. Of it they made knives, carpenters' tools, pins used by women on their heads and dresses, their polished mirrors, "and all their rakes and hammers," so that they worked more in mines of copper than in others, preferring it to gold and silver. It is very evident that this *anta* was bronze. Persons not practically acquainted with it would pronounce it copper, from its resemblance to that metal. The native word was probably expressive of its true character, but misunderstood by the invaders.

O, P, Q, T, differ in form, yet were evidently designed for the same purpose, whatever that was. They have been named whistles for want of a better appellation, because sounds resembling those produced by the tube of a key, or by blowing into any small perforation, may be drawn from them. A perpendicular hole is formed on the top of each, and across it a transverse wire has been cast in a little below the surface. (See the sections O′, P′, Q′, T′.) The one representing the head of an Indian (O) is the smallest. Solid, like the rest, its weight is less than an ounce; and, though corroded, the features are well defined. The truncated conical cap is ornamented as figured; and the acullico in the mouth, or quid of coca, is shown by the little bulb or swelling.

P is one inch and a quarter high, and as wide across the widest part. It is of copper. At two of its six sides, a couple of minute serpents of silver are inlaid.

Q is a short cylinder, nearly an inch in diameter, and five-eighths of an inch thick. An anchor-looking figure is sunk in at two opposite parts of the periphery.

T is not unlike the mummy of a cat. It represents the animal "quinquincho;" is nearly two inches long, rather over half an inch high, and weighs about a quarter of a pound. The metal is shrunk at the under side, as if it had been poured into an open mould with that part uppermost.

S S′. A pair of spring pincers or tweezers, one inch and a quarter long. The metal is thickest at the bend. They are little better than a piece of sheet copper, bent like them.

U. A rough ingot of bronze, sixteen inches long, nearly two inches wide at the middle, and five-eighths of an inch thick. It was found with the war-clubs. It rings rather sharp, and is of an alloy similar to the cutting instruments in the same group.

Gold, Silver, Champi, &c.

Figure 1. A full-length figure of a female, in silver. It is two and a half inches high, but does not weigh as much as a quarter of a dollar—being one of those thin specimens mentioned by the early historians. I could not detect traces of soldering except at the feet. At the inside of the legs the metal laps, and is unsoldered. The head is large beyond all proportion. This mode of dressing the hair is the same in all the figures of females. Figure 2 shows the mode of securing it behind.

Figure 3. A bust of a hunchback, in bronze, not quite two inches high, and much corroded. The bulb in the cheek denotes the quid of coca. The weight of this bust is light in proportion to its bulk, showing that tin preponderates in the alloy. It is the best proportioned figure of the whole, and apparently the oldest.

Figures 4 and 5 are solid images, in "*champi*," one and a half inches high, and smooth and

bright, as if just finished. Figure 4 is a male, with the coca quid, and a cap with horizontal folds. The hands (imperfectly developed) are placed on the breast, the prevailing attitude. Figure 6 shows the disposition of the hair of figure 5. The ears, large and stretched in the man, are invisible in the female. The two figures are supposed to represent a man and his wife.

Figure 7 is of the same material; an Indian seated on his hams, the hands resting on the ground. The cap is similar to that on figure 4; the height is rather less than an inch; the features rude and imperfect; the whole much corroded.

Figures 8 and 9. Two views of one image, in silver; an Inca or Cacique, with the dress and badges of his office, and the best finished, if not the best modelled, figure of the whole. The head, as usual, is too large, and the arms are withered. The height is two inches, and the whole solid. Eight golden spokes radiate from the rim of the conical hat or cap, the front of which is ornamented with dotted rays. Two convex plates of gold are worn at the ears. A species of cassock passes over the shoulders, and reaches to the knees in the front and rear. An outer robe passes over it, but descends only half way. Plaits of hair, or hat-strings, hang down upon the breast. A silver baton with a swell on it is in the right hand, and something appears to have once occupied the other.

Figure 10. Solid silver; a llama, size of the sketch. The joints of the moulds in which it was cast are indicated.

Figure 11. A llama or one of its congeners, two inches high, and as long. It has evidently been worn as an ornament or jewel. A loop of silver wire is soldered at the junction of the neck and trunk, while the tail is bent to form another. Two ingots—one of silver, the other of gold—are soldered on the back of the animal, clearly showing the ancient use of the llama in transporting blocks of these metals. (The ingots are figured beneath.) At the present time llamas are of the greatest utility, as they frequently carry the metals from the mines in places where declivities are so steep that neither asses nor mules could keep their footing.

Figures 12 *and* 12*a*. Another image of solid silver, less than two inches high. It is rudely formed, with the eyes, nose, and hands preternaturally large. The head is remarkably flattened, and the lobes of the ears are stretched down to the shoulders.

Figure 14. A statuette of a man, solid, nine and a half inches high, very heavy, and black with age. The nose is large and aquiline; the ears slit and stretched; the cap ribbed horizontally as in figures 4 and 7. The material of this casting, according to the catalogue, is "*champi*," but from examination it appeared to me to be pure copper, coated or plated by some means with silver, for when the latter was cut through the copper appeared. Ridges on the inside of the thighs and legs show the meeting of the two halves of the mould.

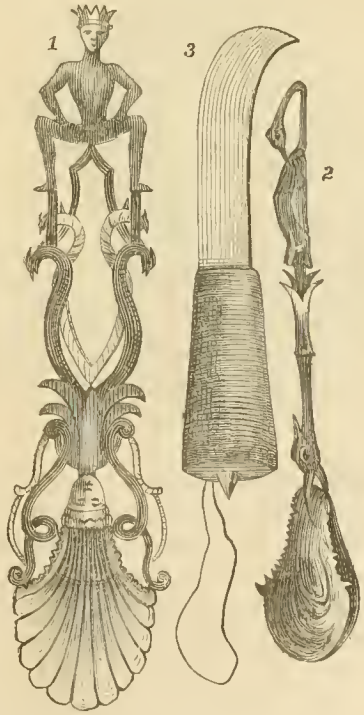
Figures 15 and 16 are two sketches of one subject. This image is that of a female, and of the same material and dimensions as the preceding one. Both were discovered together, and are supposed to represent an Inca or Cacique and his wife. A number of gold, silver, and bronze bands are let in flush with the surface. Perhaps they were placed in the moulds before the metal was run in. By looking at the initial letters placed opposite these bands in figure 15, it will be seen that two are of gold, five of silver, and three of baser metal. The eyes and paps are of gold. The bands vary from three-eighths to three-sixteenths of an inch in width, and their ends lap over each other and are imperfectly united. Their thickness appeared in one place over an eighth of an inch. The whole figure is black; but if scratched anywhere silver appears, and when cut through copper comes to view. The ankle-bones were quite prominent, the fingers poorly portrayed, the feet flat above, with sand-holes in several parts; the rather rude joints of the flasks observable on the casting, as in figure 14, leaving no room to doubt that those essential devices in our foundries were used by old Peruvian smiths.

Figure 13. A *chuspa*, or small bag, used for carrying tobacco or coca. The weft is cotton; the warp Alpaca wool. The front is eight inches square, and ornamented with figures wrought in the fabric as represented. The strap is a species of knitted work, very similar to what modern Indians produce. These bags were suspended at the left side, the straps going over the

right shoulder. This antique is in tolerablep reservation, although the owner, from whose body it was taken, has long been reduced to dust.

The magic effects ascribed by old writers to the use of coca—enabling men to pass days without food, and under severe labors—are testified to by modern travellers. Von Tschudi says it is in the highest degree nutritious; that with its aid miners and others undergo incredible fatigue on very spare diet; that those who are in the habit of masticating it require little food, &c. Though a powerful stimulant, and its effects on the looks of inveterate chewers anything but attractive, its moderate use, he thinks, is not merely innoxious, but conducive to health. An Indian employed by him in laborious digging for five days and nights, tasted no food during that time. Every three hours he chewed half an ounce of coca-leaves, and kept a quid continually in his mouth. Individuals of great age have chewed it from infancy. He refers to Indians who have attained 130 years. One living in 1839 was 142 years old, and for 90 years had never tasted water—not a drop! During that time he had drunk only *chicha*—a filthy and intoxicating liquor. When 11 years of age, he began to chew coca three times a day, and continued the practice through the rest of his life. Von Tschudi's account of the plant and its culture is substantially the same as that of old Garcilasso.

Specimens of carving by modern Peruvians are subjoined. Figures 1 and 2 are spoons, each cut out of one piece of wood. Figure 3 is one of their knives. The blade, hammered out of hoop-iron, was secured in a slit in the haft by strong cotton twine. It is not unusual for Peruvian Indians to pass over into the southwestern provinces of Brazil with little ventures of carved work. The specimens figured were purchased from one of the travelling artists.



ADDITIONAL OBSERVATIONS.

It is hard to concede that people who produced such wards as those figured on page 130 had not realized the potter's wheel, or some other form of the turning-lathe; and yet no distinct trace of it was apparent on any one article. At the same time, to outward appearance, the sections of the vases presented almost perfect circles. To account for this uniformity, it has been suggested that gourds and other vegetable shells were often used as cores or pattern-blocks over which to apply the paste, and were burnt out in the process of baking. That the original forms of vases are to be found in nature, is undoubtedly true; but whether gourds were ever used as moulds in the manner suggested is very questionable. It would be difficult to reconcile it with the diversity of shapes, and with the remarkable uniformity observable in the thickness of the material in many articles; and then another difficulty would be, the unavoidable cracking of the paste in drying, in consequence of the unyielding patterns preventing all shrinkage. Moreover, in most cases the natural type would be as useful and more durable than a brittle copy in terra-cotta, for which it was to be sacrificed.

There is evidence enough in works of old Mexican and Peruvian artists that they were no more guilty of such a useless destruction of models and waste of labor than modern potters are. That vegetable forms which relieve themselves, such as the fruit of the cup and saucer tree of Equatorial America, a large kind of acorn, may have been employed, is exceedingly probable, because one pattern would suffice for an unlimited number of copies. Still, one side only of a copy could be thus produced. To complete the device, a mould consisting of two parts, one convex, the other concave, between which to press the paste, was required; and it is demonstrable that artificially-made moulds of the kind were employed in Mexico and Peru. There are numerous flat vases, figured and plain, which have been made in halves, each formed in a mould, and the two united while the clay remained plastic. Most of the vessels which were too small for the introduction of the hand were thus formed, the junction being seen quite distinct in such as have become broken. The flat vessels *j j'* and *d d'* (page 130) were made in halves and thus united, and most likely *i* also. I think it doubtful if there are more than two or three articles in the group that were not shaped more or less in moulds. We have ancient vases on Plate IX, of which the lower and widest parts were fashioned in moulds, and the narrower parts of the bodies and necks gathered in by the fingers, whose marks contrast with the smooth and uniform moulded surface.

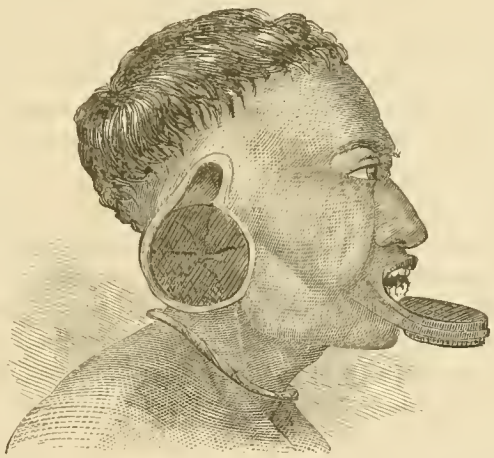
The testimony of early writers is confirmed in several interesting particulars by the figures on page 141. There were three things instituted by Manco Capac, by which his male descendants were to be distinguished: 1. Shaving the head, and leaving (like the Chinese) a single lock or cue. 2. Wearing large ear ornaments; and 3. The Llautu, a head-dress composed of a long and narrow strip of cloth of divers colors, wound round the head in the manner of a turban.

That the operation of removing the hair was tedious and painful, we learn from one who had undergone it. The incident shows how wealthy young pagans valued the same instruments of the toilet as our juvenile fashionables. Garcilasso remarks, that the shaving, or shearing, was performed with much difficulty by sharp flints; "whence it was, that a certain young Inca said to one of my school-fellows, with whom he was taught to write and read, that had the Spaniards introduced no other inventions than *scissors, looking-glasses, and combs*, they had deserved all the gold and silver which the country produced." We know from other sources that nothing like scissors was previously known to the Peruvians, and hence it is no wonder, that the easy and rapid manner in which they operated should have elicited general admiration. Their metallic mirrors, made with great toil, and constantly losing their polish by the action of the air, were gladly superseded by those of glass. The fancy horn and ivory combs of Europe were also vastly superior to the native wooden ones, of which many were simply thorns inserted into short lengths of cane.

As the heads of all the male figures are covered, the particular style of hair-cutting, and the disposition of the cue, are not represented; but the other marks of distinction are fully shown. The operation of boring the ear was performed by women with a sharp thorn, and the opening gradually enlarged, till, in some instances, the hand could be readily passed through it; for the large auricular ornaments were generally, if not always, embraced by the outstretched lobe—not pendant from it. When the native historian speaks of ear *rings*, it is difficult to understand him: in most places he means round or elliptical discs. He says "the hole (in the lobe) was made so wide that it is wonderful to conceive how it is possible for the velvet of the ear to be extended so far as to receive an ear-ring as large as the frame (block) of a pulley; for it was made in the form of those with which we draw up pitchers from a well." In figures 3, 4, 8, 9, and 14, the outstretched lobes appear. In some, the ornamented discs are in their places.

In process of time, we are told, the *people* had permission to bore their ears, though not so wide as those of the Incas, and that their ornaments were varied according to their nations and tribes. To the Mayus and Cancus, Manco Capac assigned rings of plaited straw; to the Pogues, a ball of white wool; to the Munas, Huarues, and Chiliquis, ornaments of reed; to the Rimactampas, rings, or rather discs of wood; to the Urcos, Yucays, Tampus, and other tribes on the river Yucay, ornaments larger than others; "but limiting them so that it might not equal those of their rulers." To the tribes who had their ears so unnaturally stretched, the Spaniards applied the term *oregons* or *orejons*—long-eared, or flap-eared.*

The old Peruvian mode of wearing ear-jewels is still common with many South American tribes. The annexed sketch exhibits a modern Brazilian Indian, with discs of Pito wood, (light as cork) three inches diameter, and one inch thick, in his ears, and a similar one in his under lip.



The llautu is fully represented in figures 4, 7, 14; and its presence shows that the images were intended to represent Incas.

The wives of the Incas, and females generally, wore no covering on the head, nor do they appear with any auricular pendants.

The rude figure 12 illustrates, and is illustrated by, another passage in the Royal Commentaries, which informs us that ancient barbarous tribes, subdued by the Incas were in the habit of compressing the heads of their offspring between two boards.

On looking over the groups on pages 134 and 136, a question naturally arises respecting the implements and process of fabrication, in the acknowledged absence of iron. If articles in various metals and hard alloys could be readily manufactured by old artisans, where was the alleged difficulty in their dressing stone? Would not the materials of the tools employed in one case suffice for those of the other? The answer would seem to be in the affirmative, but it would be

* Has the Territory of Oregon derived its name from the distorted ears of its early inhabitants?

erroneous; for there certainly is something more puzzling in the carvings in granite, porphyry, and other hard rocks, by ancient Americans, than in the problems presented in articles and edge-tools of metal. In figures I, L, M, M′, page 138, we have cutting instruments. Of their relative hardness I have already spoken. Now, were harder and sharper tools required in their construction? or, if not, in what manner were they formed?

When the tapered and heavy sceptre A 1, page 138, was placed in my hands, I at once inferred a casting from a wooden pattern, which might retain marks of a turning-tool in forming that pattern, and possibly of another in finishing the metal itself on a lathe; but I was mistaken—there is not a sign of either. I reasoned from modern methods with which ancient practice did not and could not accord, in the absence of an agent which makes all the difference between the arts of civilized and those of semi-civilized states. The instrument had been but little labored after leaving the loam in which it was cast, and that little had been confined to abrasion. In appearance the blade was quite straight; but, on looking along it lengthwise, many waving deviations appeared. Grasping a part in one hand, and quickly turning it to and fro with the other, also showed that its section, though seemingly round to the eye, was not really so—a criterion, this, known to most artists as a severe one. The pattern had *not* been turned, nor had its metallic fac-simile been finished in a lathe.

In the articles A, D, H, page 138, and in the openings for handles in M, N, were no marks of a file, nor of any cutting implement whatever, nor on any metallic article in the collection. The conclusion was irresistible that no other dressing was given to them than what grinding and polishing-stones could impart. Files, we know the ancient Mexicans and Peruvians had not; and, had we not been expressly told so by early historians, the fact would appear obvious in the absence of the only metal of which they could have been made. If formed of copper alloys, of what use, since they could have been no harder than edge-tools of the same? For dressing metals they would have been worthless, and for reducing wood of little avail. All goods, then, of old American smiths, were solely produced by the crucible, hammer, and grindstone, to which the blow-pipe in soldering and the process of chasing must be added.

Let us see if we can reconcile this with the articles before us, by showing that no cutting-tool was required in their fabrication.

There is in the collection only one hollow-wrought specimen—figure 1, page 141—but it represents a large class of American antiques. That tribes far less advanced than the old Peruvians spread gold, silver, and other metals into leaves or sheets, by hammers and anvils of stone, is too commonly known to need corroboration. Existing examples abound in Africa, Madagascar, Sumatra, Borneo, and other islands of the Indian Archipelago, and also in both Americas. The small sheet, figure F, page 138, therefore presents no difficulty, if even bronze hammers and stakes had been unknown to those who formed it; nor does the embossing of such, or raising them into cups, &c.—results of convexity in the faces of hammers and anvils, and more or less developed with spreading every leaf of metal. But when the design could not be perfected by bulging up of a flat piece, as in figure 1, page 141, then the metal was folded, the corresponding edges soldered, and the whole worked on stakes to a rude resemblance of the object intended. Next, the interior was filled with a fluid composition of wax and resin. On this, when cool and hardened, the metal was wrought, and, where required, sunk into it by punchets, until the contour was perfected, and the details of ornament brought out; that is, by the universal process of *chasing*—one common to enlightened and semi-barbarous artisans, and which originated with the latter. For this process, punchets and hammers of bronze, or even of stone, are all-sufficient.

When the chasing was completed, the article was heated sufficiently to fuse and discharge the resinous compounds, precisely as is the manner of modern jewellers and silversmiths. If a base or any addition was required, it was annexed, as were the feet in figure 1, page 141, by solder.

That Peruvian workmen were very expert in soldering is abundantly verified by works extant.

In these thin images, it is seldom to be detected without difficulty, and sometimes the joints elude close scrutiny. Hollow figures of the kind were anciently, and are still, somewhat common with Oriental silver-workers. I have seen Siamese specimens in which the metal is at least as thin again as in the Peruvian one described—too thin, in fact, to preserve their forms, if divested of the resinous substance on which they were chased, and which, therefore, is left in them; the soldering being necessarily more apparent than in the heavier Peruvian articles. Much of the same kind of work was produced by Israelitish artists. They hammered, we are told, gold and silver into thin plates, and then wrought them into embossed work. The cherubim on the ark were light, hollow figures of the kind. Various are the references to "beaten work," and "thin work," in contra-distinction to that turned out by the founder.

The spreading of the softer metals into leaves by the hammer, undoubtedly preceded the art of *casting* them into requisite forms. The mound-builders of North America fabricated rude trinkets and implements, of native copper, in abundance, by "beating;" but, as yet, neither hatchet nor ornament produced from the crucible has been discovered among the quantities disinterred.

Every other metallic work figured on page 141 is *solid* and *cast*. Those which could be moulded in a *pair* of flasks obviously were so, as the practice is at this day with us. Marks of the meeting of the two halves are as distinct as in articles in modern founders' shops, and invariably in places where the little superfluous ridges could not be removed by abrasion. Of simple objects thus made, little need be said. They are as the crucible left them, save what little polishing some may have acquired by means which every artist possesses. No cutting-tool was required in their fabrication, unless in making their *patterns*. Those, if of wood, were, of course, wrought into shape by knives and edge-tools of bronze, shell, or stone—a task requiring no small amount of patience and skill. But of this anon.

The difficulty lies in such things as figure A 1 and R, page 138, which has four sunken impressions round the handle, and a wild cat in full relief on its end, which could no more be cast in flasks in the ordinary way than figure I, of the same page, figure 8, page 141, and some others. Then there is the inlaid work in the swell that divides the handle from the blade in A 1. How were the recesses formed and filled without cutting-tools? The same question arises on contemplating the same kind of ornament in other figures of the same plate, and the golden spokes in the silver head-piece, figure 8, and the bronze, silver, and golden bands round figure 15, on page 141. An explication, then, of the fabrication of this article, covers every difficulty presented by the rest—it includes them all, and others, if such are extant, still more complex.

The solution is in one word—*Patterns of Wax*. These, whether intricate in detail or plain, but such as could not economically be produced from other substances, were modelled by hand, buried in a mould of plaster or clay, which when dried was heated, the wax run out, and its place filled with molten metal. The minutest finish was thus given to every essential part, so as to require no subsequent carving—nothing but what the grindstone or polishing process could impart. Inlaid material was bedded in the pattern, and consequently left in the mould, and, surrounded (except at the surface) by the flowing metal, become inlaid in the latter. The unsoldered joints in the band of figure 15, page 141, are thus accounted for. The golden spokes and ear ornaments of figure 8 had the ends imbedded in the waxen type, which by that means became equally embraced by and imbedded in the fused silver. The little transverse wires were inserted in the models of figures O, P, Q, T, page 138, and consequently retained the same position in the metallic copy. This explanation accords with every ancient piece of work. It removes every difficulty, and is the only one I can conceive that does so.

Patterns wrought out of plastic materials were obviously the best of all possible substitutes for those of wood, when proper and effectual tools for working the latter could not be had. They were most easily made; cheap, simple, efficient; and such as our founders would unquestionably fall back on, were iron withdrawn from the earth. Expert in modelling we know the old Peruvian artists were. They imitated in metal almost every native animal, bird, insect,

herb, tree, plant, and fish, as well as human figures. "Many attended to nothing else but to make new inventions and rare works in metals." (Garcilasso, B. 3, cap. 24.) The uniformity and universality of the process of their founding necessarily made them proficients in it. Whatever forms could be modelled in wax were without difficulty reproduced in metal. Peruvians and Mexicans are still famous for their carving and modelling powers.

The Peruvians had gold, silver, and copper wire, most likely drawn through die-plates of stone, though those of bronze may have been used for the softer materials. Laplanders draw tin wire through perforations made in bone or in reindeer's horns. Garcilasso remarks that his ancient countrymen were expert in boring metals, but certainly not with anything like our drills. The principle was probably that of abrasion—the same as all savages have developed, and in the practice of which most are singularly expert; perforating shells, bones, teeth, stones, and even glass, with a rapidity that would puzzle white artists. A revolving stick of wood, or copper, whose point is supplied with emery, sand, or other natural cutting-powder, is in their hands what a drill is in ours; it is the germ of the lapidary's wheel—its use the origin of his art.

That iron was employed in remote times in America, may eventually be established. At the advent of Manco Capac, the Peruvians are represented in the lowest depths of barbarism. Their improvement began with him, and continued under his successors to the arrival of the Spaniards. During that period it is conceded that tools of iron were not used, and yet structures of massive cut stones, weighing several tons each, it is said, were then erected, and the stones so accurately jointed that not the point of a penknife can find entrance. The question naturally arises, with what material were they cut? It has been said, with tempered copper. When we ask how that metal was made sufficiently hard, and at the same time retain other essential properties of a granite-cutting implement, we are told the art has been lost! In thus cutting a knot of their own tying, writers have unnecessarily perplexed themselves and their readers, and without perceiving the contradiction involved. Applied to Americans because they had no iron, the dictum has been offered to account for similar sculptures of the Egyptians who had steel, and who had constant intercourse with the oldest city of the earth—or one of the oldest, and memorable for its fabrication of swords that without injury to their edges could chop iron bolts in two.

It is more reasonable to infer that the old dressed-granite buildings of Central America and Peru date from times anterior to those of the Incas—times in which iron was known. The comparative freshness of such remains presents no difficulty. The advent of Manco Capac is carried back to the twelfth century—only seven hundred years—while architectural and other antiquities equally fresh are extant in Europe and the East, and are known to be from two to three thousand years old. That there was a previous epoch of civilization in Peru has always been confirmed by traditions of the natives relating to ancient structures. Ignorant of the origin of these, they did exactly what people of the Old World did under similar circumstances—ascribed them to a race of beings superior to themselves—to the gods. Garcilasso himself refers them to a people who had iron. There is one page of his work bearing on the subject of special interest, and the more so since ancient monolithic structures in Peru are no longer a question. They are yet extant.

Mayta Capac, the fourth Inca, subdued the Indians of Tiahuanaco. "Amongst the mighty works and buildings of that country there is a certain hill or heap of earth thrown up by hand, which is so high that it is a subject of great admiration; and, lest with time it should settle or sink lower, it is founded on great stones, cemented together; and to what end this was done no man can conjecture, unless it were, like the pyramids in Egypt, to remain for a trophy of the greatness of that monarch who erected it. On one side of this mighty heap are the statues of two giants, cut in stone, with long robes to the ground, and wreaths or binders about their heads, which being much impaired by time, shows the antiquity of them. There is also a strange wall to be seen, raised with stones of an extraordinary bigness; and what is most won-

derful to consider is, how or in what manner they were brought thither by force of men who had not yet attained to the knowledge of engines fit for such a work; and from what place they were brought, there being no rocks or quarries but such as are at a far distance from thence. There appear also many great and lofty edifices; and, what is more strange, there are in divers places great portals of stone, and many of them whole and perfect, *made of one single and entire stone*, which, being raised on pedestals, are found by those who have measured them to be thirty feet in length and fifteen feet in breadth, which pedestals, as well as the arches of the portals, were all *of one single stone:* and then we may consider how great those stones were before they were shaped, and what tools of iron were requisite for such a labor.

"The natives report that these buildings, and others of a like nature not mentioned here, *were raised before the times of the Incas;* and that the model of the fortress at Cuzco was taken from them, as we shall hereafter more particularly describe. Who they were that erected them they do not know, only they have heard say by tradition from their ancestors that those prodigious works were the effects of one night's labor, which seem in reality to have been the beginnings only and foundations for some mighty structure. Thus much Pedro de Cieça, in his remarks concerning Peru and its several provinces, relates; to which I shall further add, what was told me by a certain priest, called Diego de Alcobaça, who was my school-fellow, and whom I may call my brother, because we were both born in the same house, and his father educated me as my tutor and master: this person, I say, amongst the many relations of things which both he and others sent me concerning my own country, coming to speak of the buildings of Tiahuanaco, hath these words: 'In Tiahuanaco, which is a province of Callao, amongst many other antiquities worthy of immortal memory, there is one particularly famous adjoining to the lake, which is called by the Spaniards Chucuytu, though its true name be Chuquivitu. This is a pile of monstrous buildings, to which is an open court of fifteen yards square every way; the building is two stories high, and on one side of this great yard or square is a large hall, of forty-five feet in length and twenty-two feet in breadth; the covering appears to be thatch, like those on the temple of the sun, in the city of Cuzco. All this court, or yard, which we mention, with its walls, floor, hall, roof, portals and jambs of the doors, and back-gate to this building, is all *of one entire stone*, hewn out of a rock; the walls of the court and of the hall are three quarters of a yard thick; and such also is the covering or roof, which, though it may seem to be thatched with straw, is yet of stone, for the Indians have worked it so artificially, and with those natural lines, that the stones appear like straw laid in the most curious manner of thatch. The waters of the lake beat against the side of these walls, and both this and all the other edifices hereabout were all, as the natives report, dedicated to the Maker of the Universe. Moreover, besides these works there are divers others, figures of men and women cut in stone so naturally that they seem to be living: some of them are drinking with cups in their hands, some are sitting, some standing, some are walking in the stream which glides by the walls; other statues there are of women carrying children in their arms and in the folds of their garments; others with them on their backs, and in a thousand other manners and postures. The Indians of those days report, that for the great sins of that people, in having stoned a stranger who passed through their province, God, in his judgment, had converted those men and women into stone.'"

Engravings from modern sketches of Tiahuanacoan monoliths, and of other remarkable ruins of Cuzco, Guanaco el Viejo, Pachacamac, on the islands of Titicaca and Coati, have been recently published by Dr. Von Tschudi and others.

There are points of striking resemblance in the mythology of the Peruvians and that of Eastern nations. Manco Capac, like Osiris, and other founders of empires, taught men to cultivate the ground; and his wife, like Isis and Minerva, educated the women in spinning and weaving, and domestic duties. Much of it is based on agriculture and irrigation. "The maker of all things placed in heaven a virgin, a daughter of a king, holding a bucket of water in her hand for the refreshment of the earth." One of the early Incas embodied the story in poetry,

which Valera translates from the Quippus into Latin. It ran thus: "Fair nymph, thy brother strikes now thine urn, whose blow is thunder and lightning. But thou, nymph, pouring forth thy water, droppest rain, and again sendeth hail or snow. The maker of the world, VIRACOCHA, hath committed this office unto thee."

But there are things more durable and reliable than poems. *Wells* excavated in rock, are the most permanent of human impressions on the earth; nothing but natural convulsions can erase them: hence at this hour, water is drawn from the same wells at which the patriarchs watered their flocks. The renowned cities of Egypt, Canaan, Judea, Arabia, Persia, Assyria, Asia Minor, India, and Greece, have been swept away, but round some of their wells women now cluster with their vases, as their predecessors did upwards of thirty, and probably upwards of forty centuries ago. Among these are wells, the origin of which goes back into the mythic ages. It has been much the same on this hemisphere. The Peruvians had traditions, during the Inca rule, of giants landing on the coast and settling in the land. From the absence of rain, a scarcity of water was felt, upon which "they dug extremely deep wells, through the hard and living rock." These wells being extant, and yielding sweet water, Garcilasso refers to them as corroborating the report of a remote civilization. "Their wells and cisterns are clear testimonies of the places of their habitation; but as to the parts from whence they came, I am not able to render any account." The description of Peruvian Anakims is very similar to that of the classical Gigantes.

It was in the vicinity of Lake Titicaca, whose surface has been estimated at between two and three thousand square miles, that Manco Capac and his wife first appeared. Carried by east winds, which blow every day, across the lake, according to Indian tradition he travelled thence on foot to Cuzco. It is observable, that it is in the region of this inland lake that the monolithic and other supposed ante-Incan antiquities are found; and further, that their superiority over the Inca works is still observable. Lieutenant Gibbon says: "Among the scattered stone remains of the ancient edifices of Tiahuanaco we observed no resemblance to the stone work of Cuzco, and were surprised to find, that although the ruins were in such a dilapidated state as not to enable us to make out the character of the structures, we could perceive and were convinced of the higher order of mechanical art over that displayed in Cuzco. The stones, immense in size, were hewn square; one of them had an arched way cut in it, large enough to drive a mule through. The Cura of the town told us there was no stone of the same kind to be found in the neighborhood, and that he did not know whence they had been brought. We believe Manco Capac had nothing to do with the ancient works of Tiahuanaco. Both the hewing of the stone and structure of the language of the people are different from his, though his first appearance was among this people."

Then, in the same region, silver, copper, lead, and *tin*, the essential ingredient of bronze, abounded and abound. Tin is now carried thence over the cordilleras, and shipped on the Pacific to Europe and the United States. But the ancient inhabitants also had *iron* ore, a still higher element of civilization, and one which, from their works extant, we infer they converted into tools. That such tools have not been found is no proof against their early use in Peru, any more than in Egypt, and other lands. Lead, tin, bronze, and copper, silver and gold, have been preserved from one to two thousand years in soils that dissolve iron in a century or two.

At the conquest, the Peruvians, like all people equally advanced and progressing, were gradually approaching the realization of iron, and would probably have realized it by this time had they not been interfered with from without. There are many indications that they were awakening to its value by observing the properties of its ores. Speaking of silversmiths and other artisans, Garcilasso tells us they had no iron anvils, for want of the knowledge of separating that metal from its ores, "of which they had several mines."

APPENDIX F.

ZOOLOGY.

MAMMALS	By S. F. Baird.
BIRDS	John Cassin.
REPTILES	Charles Girard.
FISHES	Charles Girard.
CRUSTACEA	Charles Girard.
SHELLS	A. A. Gould.

MAMMALS.

BY S. F. BAIRD.

In the following pages it is proposed to present a few points in reference to the species of mammals collected in Chile, by Lieut. Gilliss, and to add a list of all the species which have been noticed in that country. This enumeration as to the species will not be materially different from that of Gay, from whose work, indeed, a large number of species have been derived. Some variations of synonymy and of systematic arrangement are believed to be called for by the present state of science.

Chile has been explored to a greater or less extent by naturalists of many nations, some of whom have merely touched at the seaports, while voyaging in connexion with cruises of scientific expeditions, others again spending a considerable time within its limits. The records of nearly all exploring expeditions, therefore, show evidence of such visits, while the transactions of many societies, as well as numerous special monographs, have carefully to be searched by those who wish to be posted up in the natural productions of this great South American republic. Among those whose writings have more or less reference to the natural history of Chile, are Molina, Kittlitz, Meyen, Darwin, Dana, Peale, Gould, Tschudi, von Bibra, Bridges, Waterhouse, Hartlaub, Cuming, Philippi, and a number of others. To the enterprise of M. Claude Gay, however, we are indebted for the most systematic and complete work on the general natural history of Chile, embracing a full record of what was already known, with many additional details, published for the first time by him. It was scarcely to be expected, therefore, that Lieut. Gilliss would be able to add new species to the natural history of the State, especially in view of the fact that his mission was especially an astronomical one, giving but little time for attention to anything else. The records of the present volume, however, show that he was quite successful in obtaining new species of birds, reptiles, fishes, crustacea, and fossils, and of adding greatly to our knowledge of the distribution of species. The collections made by him, indeed, embrace all branches of natural history, in some of which they are very full.

FELIS CONCOLOR, L.

Felis concolor, *L.* Mantissa, 1871, 522, Pl. ii.
Gm. Syst. Nat. I, 1788, 79, 9.
Fischer, Synopsis Mamm. 1829, 197.
Wagner, Suppl. Schreb. II, 1840, 467.
Schinz, Syn. Mamm. I, 1844, 428.
Gay, Hist. Chile, Zoologia, I, 1847, 65.
Aud. & Bach. N. Am. Quadrupeds, II, 1851, 305, Pl. xcvi, xcvii.
Burmeister, Thiere Brasiliens, Mamm. I, 1854, 88.
Felis discolor, Schreb. Saügt. Tab. 104.
Gm. Syst. Nat. I, 1788, 79.
Felis puma, Shaw, Gen. Zool. I, 1800, 358, Pl. lxxxix.
Traill, in Mem. Wern. Soc. IV, 2.

Guazuara, Azara, Essai I, 1801, 133.
Cuguacuarana, Marcgrave, Hist. Nat. Bras. 1648, 235.
Vulg. *Panther*, or *Puma*. *Cougar*. *Leon*.

The well-known panther of the United States is one of the few species of mammals belonging to North America that are distributed over the southern half of our continent. It is, however, as well known in Brazil, Paraguay, and Chile, as in the forests of North America. Its extreme southern range is to Patagonia, about latitude 53° or 54° in South America, and to about 49° or 54° in North America. Its habits are much the same everywhere, confining itself to extensive wooded districts, or the belts of timber along the borders of streams; not often seen on the open plains, like the jaguar. The panther is much less dreaded in South America than the jaguar.

CANIS MAGELLANICUS, Gray.

Canis magellanicus, Gray, Pr. Zool. Soc. Lond. IV, 1836, 88.
Waterh. Zool. Beagle, 1838, 10, Pl. v.
Wagner, Suppl. Schreber, I, 1844, 416.
Gay, Hist. Chile, Zoologia, I, 1847, 89.
Vulpes magellanica, Gray, Mag. Nat. Hist. I, 1837, 578.
Culpeu, Molina, Comp. Chile, I, 330, 332.

This large fox, exceeding in size all the North American species, excepting, perhaps, *Vulpes macrourus*, Baird, was first made known to naturalists by specimens brought from Tierra del Fuego by Captain King. It is quite abundant in Chile as far north as Copiapó, and has thus a range of at least 1,600 miles. A remarkable peculiarity in respect to this animal is mentioned by Molina, and strongly corroborated by Gay, namely: that when it sees a man it runs towards him, and, standing at a distance of only a few yards, gazes attentively at him. This, of course, gives an excellent opportunity for killing the fox; and it is added, that large numbers are annually destroyed in this way, without the acquisition by the race of a wholesome distrust of mankind.

CANIS AZARAE, Max.

Canis azarae, Max. Beit. Nat. Braziliens, II, 1826, 338.
Ib. Abbild. Taf. xxiii.
Fischer, Syn. Mamm. 1829, 191.
Waterhouse, Zool. Beagle, Mammalia, 1838, 14, Pl. vii.
Wagner, Suppl. Schreber, Saügt. II, 1841, 534, Tab. xcii, A.
Schinz, Synopsis Mamm. I, 1844, 418.
Gay, Hist. Chile, Zoologia I, 1847, 61.
Burmeister, Thiere Brasiliens, 1, 1854, 96.
Canis brasiliensis, Lund, Bras. Dyrv. Taf. xlii, f. 81–3.
Canis melanostomus, Wagn. Wieg. Archiv. 1843, 358.—1846, 147.
Agourachay, Azara, Hist. Nat. Quad. Parag. I, 1801, 317.
Vulg. *Chilla*, in Chile; *Raposo de Mato*, Brazil; *Agourachay*, Paraguay.

This fox is rather smaller than the *Vulpes fulvus* of North America; much less than *C. magellanicus*. In size and general appearance it bears no inconsiderable resemblance to the *Vulpes velox*, or Kit fox, of the Missouri plains. Gay, however, and others, raise a serious question as to there being any essential difference between *Canis azarae* and *magellanicus*.

This animal has a very wide range; so extended, indeed, as to excite a strong suspicion that

there are really several species confounded together. This is confirmed by serious discrepancies in the descriptions made from specimens of different localities, as from Brazil, Paraguay, Chile, Patagonia, and the shores of the strait of Magellan. They burrow in the ground, and do not venture from their holes during the day; and not being very fleet, are without difficulty taken by the dogs.

According to Burmeister, the *Canis melampus*, of Wagner, Wiegman's Archiv, 1843, 358, is only a very dark-colored variety of this rather remarkable species, from the interior plateaus of Brazil.

The *Canis azarae* belongs to the section *Lycalopex* of Burmeister, or jackal foxes, characterized by a long tail reaching to the ground, and the absence of an elevated parietal crest to the skull.

GALICTIS VITTATA, Bell.

Viverra vittata, Schreber, Saügt. III, 447, Tab. 124.
Gm. Syst. Nat. I, 1788, 89.
Gulo vittatus, Desm. Mamm. 175, 268.
Rengger, Paraguay, 226.
Fischer, Synopsis, 1829, 155.
Ursus brasiliensis, Thunb. Mem. Acad. St. Petersb. VI, 401, Tab. 13.
Galictis vittata, Bell, Zool. Jour. II, 551.
Ib. Pr. Zool. Soc. Lond. 1837, 39.
Ib. Trans. Zool. Soc. Lond. II, 203, Tab. xxxv.
Waterhouse, Zool. Beagle, Mamm. 1838, 21.
Wagner, Suppl. Schreber, Saügt. II, 1841, 215.
Schinz, Synopsis Mamm. I, 1844, 331.
Gay, Hist. Chile, Zoologia, I, 1847, 51.
Burmeister, Thiere Brasiliens, I, 1854, 109.
Le Grison, Buff. XV, 65, Tab. viii.
El Huron menor. Azara I, 190.
Vulg. *Grison; Huron; Quiqui*, (Chile); *Cachorino de Mato*, (Brazil.)

This species of *Galictis* has a wide extent of distribution, occurring throughout Guiana, Brazil, Paraguay, Chile, and Patagonia. In Chile it is not rare, and commits great destruction among the eggs and poultry, having much the same habits in this respect as the weasels and minks of North America. According to Wagner, the *Galictis Allamandi* of Bell is only a very old and dark individual of the present species.

DIDELPHYS ELEGANS, Waterhouse.

Didelphys elegans, Waterhouse, Zoology of the Beagle, Mammalia, 1839, 95, Pl. xxxi. Skull. Pl. xxxv, fig. 5.
Ib. Naturalist's Library, IX, 106.
Ib. Natural History of the Mammalia, I, 1846, 515, Pl. xvi, fig. 1.
Gay, Historia de Chile, Zoologia, I, 1847, 84.
Didelphys hortensis, Reid, Pr. Zool. Soc. Lond. V, Jan. 1838, (not described.)
Thylamys elegans, Gray, List of Mammalia British Museum, 1843, 101.
Vulg. *Comadreja*, or *Llaca*.

To those familiar with the Opossum (*Didelphys virginianus*) of the United States, with its coarse, heavy appearance and comparatively large size, the application of the same name to

the elegant little *comadreja* would appear highly absurd. Its appearance is much more like that of a large mouse, although differing in the much more pointed muzzle and very thick tail. The fur has all the softness and fullness of the flying-squirrel.

This species is said to abound in Chile, especially in its maritime portion, occurring from Cobija to Curicó, in Colchagua. It climbs trees with facility and feeds upon insects, but is readily caught in traps baited with cheese or meat.

CAVIA AUSTRALIS, Geoff.

Cavia australis, Is. Geoff. in Mag. de Zool. III, 1833, Pl. xii.
D'Orbigny, Voyage dans l'Amerique, Pl. xviii.
Wagner, Suppl. Schreber, IV, 1844, 60.
Waterhouse, Nat. Hist. Mammalia, II, 1848, 180, Pl. iii, fig. 2.
Kerodon kingii, Bennet, Pr. Zool. Soc. Lond. III, Dec. 1835, 190.
Waterhouse, Zool. of Beagle, Mammalia, 1839, 88.
Gray, List of Mammalia Br. Mus. 1843, 126.

Two specimens of this cavy were taken by Lieutenant MacRae not far from Uspallata, in latitude 33°. The species was first described from Patagonia, and the extreme northern range assigned by authors is 39°. By this discovery of Lieutenant MacRae, its range in a northern direction has been extended by six degrees, although, according to the usual law, it is probably found at a greater height in proceeding towards the equator—the elevation of Uspallata being 6,000 feet.

This animal, congeneric with the well-known Guinea pig, is very common along the coast of Patagonia, from the Rio Negro to the straits of Magellan. It frequents the bottoms of hedges and the ruins of old buildings, and is said to dig deep burrows in the ground. Its food consists of seeds and green herbage, and it has been observed to ascend trees to feed on their fruits.

The skull of this species differs in many respects from that of the *Cavia aperea*, or common Guinea pig. Its peculiarities are tolerably well represented in the figure of Waterhouse on Plate vi, fig. 13.

From the general resemblance of this species to a rabbit in its form and color, it generally bears this name, and has given rise to the impression that the genus *Lepus* was to be found in Patagonia. It bears the name of Mountain Rabbit at Uspallata. To *Lagomys* the resemblance is very striking.

The *Cavia australis* is not included by authors among the animals of Chile, though it not unlikely occurs on the west side of the cordilleras.

LAGIDIUM CUVIERI, Wagn.

Lagotis cuvieri, Bennet, Pr. Zool. Soc. Lond. I, 1833.
Ib. Trans. Zool. Soc. I, 46, Pl. iv.
Lagidium cuvieri, Wagner, Suppl. Schreber, III, 1843, 306.
Waterhouse, Nat. Hist. Mam. II, 1848, 222.
?Lagidium peruanum, Meyen, Nova Acta, XVI, 578.
Tschudi, Fauna Peruana, 164.
Callomys aureus, Is. Geoff. Ann. des Sc. Nat. XXI, 1830, 291.
Vulg. *Viscacha.*

The two specimens of this species, brought home by Lieutenant Gilliss, resemble most closely the *Lagidium cuvieri*, as given by Bennet and Waterhouse, although approximating in

some respects to *L. pallipes*. They differ decidedly from the *Lagotis* (*Lagidium*) *criniger*, of Gay, both in the skin and the skull; but of the affinities of this last-mentioned species with *L. pallipes*, I can say nothing. Gay, however, mentions *L. pallipes*, and considers the two sufficiently distinct.

This species is said to be quite common on the cordilleras of Chile and Peru, living at an elevation of from five to fifteen thousand feet. The soft and fine fur is highly prized, and, mixed with wool, is woven into warm stuffs of various kinds. The skins are, however, less valuable than those of the true Chinchilla. *Chinchilla lanigera* is, however, also found in the cordilleras of Chile and Peru.

The name of *Viscacha* is applied in Brazil to the *Lagostomus trichodactylus*.

SPALACOPUS POEPPIGII, Wagl.

Spalacopus poeppigii, Wagler, Isis, 1832, 1219.
Waterhouse, Nat. Hist. of Mammalia, II, 1848, 269, Pl. ix, fig. 1.
Poephagomys ater, F. Cuv. Ann. des Sc. Nat. n. ser. I, 1834, 321, Pl. xiii.
Waterhouse, Zool. of Beagle, Mammalia, 1839, 82.
Eydoux et Gervais, Voy. de la Favorite, V, Zoologie, 1839, 17, Pl. vii.
Gay, Historia de Chile, Zoologia, I, 1847, 103.
Psammoryctes noctivagus, Poeppig, in Wieg. Archiv, I, 1835, 252.
Wagner, Suppl. Schreb. Säug. III, 1843, 318.
Psammomys, Poeppig, Reise, I, 1835, 166.
Vulg. *Cururo*, *Curucho*, *Cuyeita*.

The collections of Lieutenant Gilliss included several specimens of this curious species, which most probably is the *Mus cyanus* of Molina. It appears to be quite abundant in many parts of Chile, from Copiapó to Cauquenes, and has, to a considerable extent, the habits of the gopher, or pouched rat (*Geomys*), of North America. It excavates long passages in search of various bulbous roots, which form its principal food, consisting chiefly of a species of *Dioscorea*, or "guanque." The burrows are carried along at a depth of about ten inches, terminating at times in expanded chambers, used as storehouses. The cheeks are capable of great extension, although the species is destitute of the external cheek pouches, which render our pouched rats so conspicuous among rodents. The incisor teeth are very thick and strong.

These granaries of the Cururo are often robbed by the poorer inhabitants of Chile for the sake of the store of edible roots they are found to contain. The animal is seldom seen in the day-time, unless in cloudy weather.

MYOPOTAMUS COYPUS, Geoff.

Mus coypus, Molina, Saggio, 1782, 287.
Mus castoroides, Barrow, Linn. Trans. X, 1812, 168.
Myopotamus coypus, (Commers,) Geoff. Ann. du Mus. VI, 1805, 81.
Cuv. R. Anim. I, 214.
Waterhouse, Zool. of Beagle, Mammalia, 1839, 78.
Ib. Nat. Hist. Mammalia II, 1848, 297, Pl. xv, fig. 1.
Wagner, Suppl. Schreber, IV, 1844, 12.
Gay, Historia de Chile, Zoologia, I, 1847, 122.
Hydromys coypus, Geoff. Ann. du Mus.
Desm. Mamm. 1822, 296.
Potamys coypou, Desm. Dict. des Sc. Nat. XLIV, 491.

Castor coypus, Fischer, Synopsis, 1829, 288.
Myopotamus bonariensis, Rengger, Saüg. von Paraguay, 1830, 237.
Mastonotus popelairi, Wesmael, Bull. Acad. Roy. de Brux, 1841, 61.
Guillinomys chilensis, Lesson. Nouv. Tab. du R. A. 1842, 126.
Vulg. *Coypu* and *Nutria*.

From the preceding list of synonymes, which might have been greatly extended, it will be seen that the position among rodents of this large species has occupied to a considerable degree the attention of systematic zoologists. Until quite recently it has been placed near the beaver of North America, to which, by the fineness of its fur and some of its features, it bears a considerable resemblance. Its position has, however, been established by Waterhouse among the *Hystricidæ*, sub-family *Echimyina*, where it seems really to belong; the affinities of *Castor*, on the other hand, being essentially with the squirrels.

This species is the one which furnishes the nutria fur of commerce—an article which, from its abundance and excellence, has greatly depreciated the value of skins of the North American beaver and muskrat. It is found all through temperate South America; but it is in the river district of La Plata and in the Chonos archipelago that the skins are principally collected for purposes of commerce. It is strictly aquatic in its habits, much resembling the muskrat of North America, and, like it, feeds partly on vegetable substances and partly on shell-fish. The flesh is white and well flavored.

There is a peculiarity in the position of the nipples of the Coypu, found, indeed, in others of the *Hystricidæ*, but here most strikingly manifested, namely: in their situation on the back, or at least above the middle line of the flanks; the foremost is placed behind the shoulders, and the last one in front of the thigh. The object of this feature is to permit the young to reach the mammæ from the back of the parent while she is swimming in the water, in which most of their time is passed.

According to Waterhouse and Darwin, the precise range of this species, on the east side of the Andes, is from Peru to the Rio Chupat, in 43° 20′, although it has not been noticed by naturalists in eastern Brazil. West of the mountains it extends from about latitude 33°, or central Chile, to 48° south, or still further, but not to Tierra del Fuego.

HESPEROMYS.

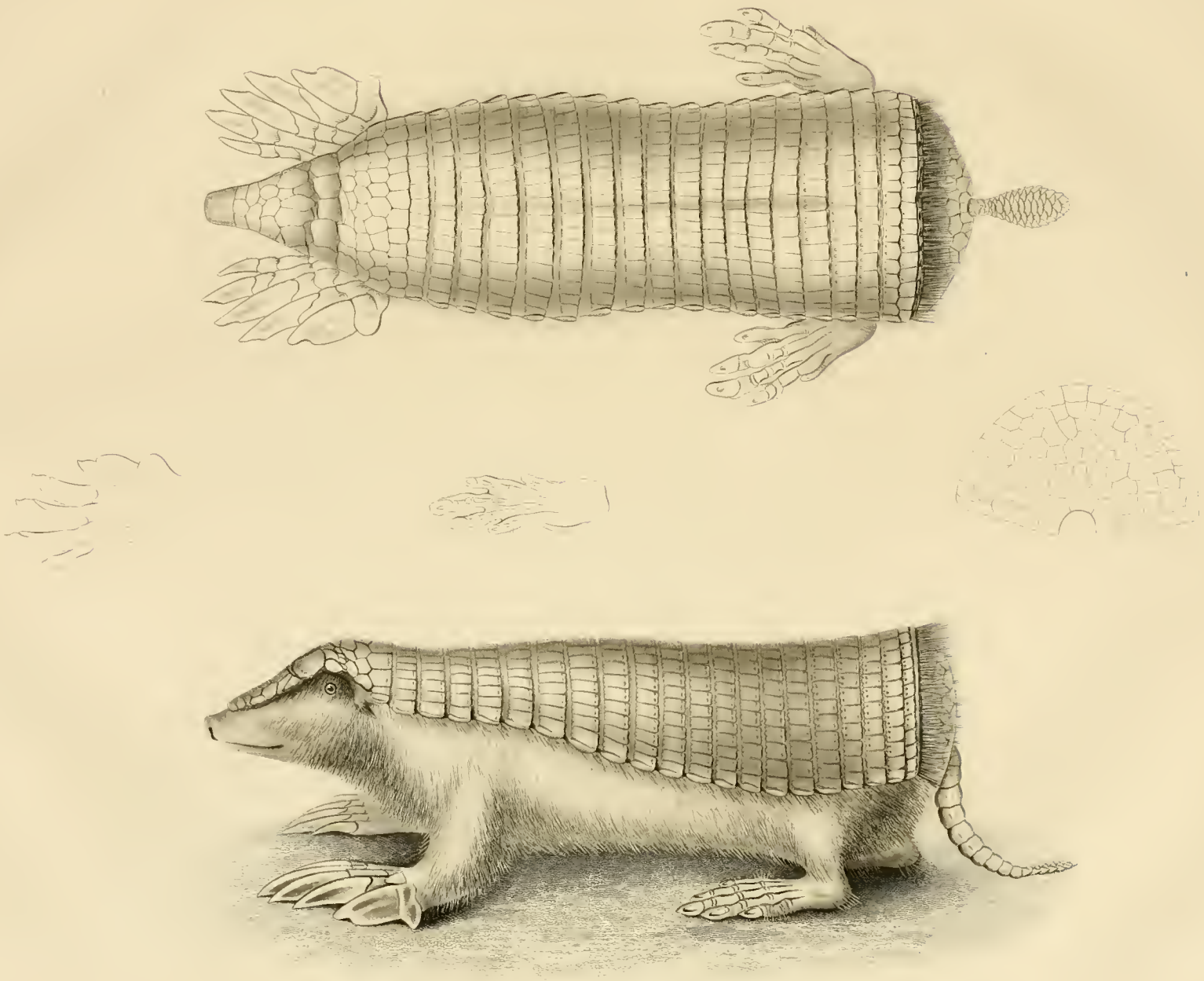
The collection of Lieutenant Gilliss contains two specimens of *Hesperomys*, which, however, I have been unable to identify, owing to their imperfect condition.

CHLAMYPHORUS TRUNCATUS, Harl.

Plate XI.

Chlamyphorus truncatus, Harl. Ann. N. Y. Lyc. I, Jan. 1825, 235.
Ib. Med. and Phys. Res. 1835.
Ib. Zool. Journ. II, 1825, 163, Pl. vi.
Yarrell, Zool. Jour. III, 1827, 544, Pl. xvi, xvii, (Osteology.)
Chlamydophorus truncatus, Wagner, Suppl. Schreber, Mam. IV, 1844, 187.
Hyrtl, Sitzb. K. Ak. Wien. Math. Nat. XII, March '54, 79.
Vulg. *Pichiciego*.

This species, which has for a long time excited the interest of naturalists since its first description by Harlan, is still very imperfectly known, and but few specimens have, even at this late day, been received into collections of natural history. It was first brought to Philadelphia by Mr. W. Colesberry, who obtained it from Mendoza, and furnished almost the only information we yet have of its habits. This specimen was given to Peale's Museum, where it



J.H. Richard Dougal Sc.

CHLAMYPHORUS TRUNCATUS Harl.

was described at length and figured by Harlan in the Annals of the New York Lyceum. On the scattering of the Philadelphia collection, it came into the possession of the Philadelphia Academy of Natural Sciences, of whose magnificent museum it now constitutes a highly valuable component.

The next specimen was received by the Zoological Society of London a few years later, and its osteology described in considerable detail by Yarrell. As, however, the skin was prepared for the museum, the bones of the feet were left attached, and could not be described with the other portions of the skeleton. This animal was preserved in spirits, without the intestines, and of course these could not be described.

The third specimen made known to naturalists was one in possession of Dr. Gemminger, of Munich, much more perfect than any of the others, as it was preserved entire, in excellent condition, in alcohol. This was purchased by Dr. Hyrtl, of Vienna, who has for some time past been engaged in preparing an elaborate monograph, to include all the details of its anatomical and external structure. From the well-known ability of Dr. Hyrtl, there is no doubt that the subject will be exhausted, as far as a single specimen will enable him so to do. The memoir will be published in the Denkschriften of the Imperial Academy of Sciences of Vienna, and may possibly have already appeared, although it has not yet reached this country. Dr. Hyrtl also obtained a dried skin of the Pichiciego, making, as far as known, three specimens in Europe.

While Lieutenant Gilliss was in Chile, his attention was called to this subject, and he made several fruitless efforts to procure specimens during his stay. About a year after his return, however, some friends having procured a fine mounted individual, presented it to him, and it is now in his possession, having served as the original of the accompanying plate. Another specimen was sent to Lieutenant Phelps, who gave it to the museum of the Cleveland Academy of Natural Science.

It will thus be seen that the six specimens on record are equally divided between Europe and America. There may be others in museums, but I have never seen mention made of them.

Not much is known of the habits of this curious animal, beyond the fact of its existing in the vicinity of Mendoza, and, on account of its nocturnal habits, appearing to be rarer than it really is.

AUCHENIA LLAMA, Desm.

Auchenia llama, Waterhouse, Zool. of Beagle, 1838, 26.
Llama guanaco, Gay, Hist. de Chile, Zoologia, I, 1847, 153.

I have cited only the above synonymes of the Guanaco, as, according to Tschudi, there are really several species in what has hitherto been considered as one, and I have not now the material for deciding the question. All the specimens brought by Lieutenant Gilliss belong to the robust form living wild in the mountains of Chile, and referred to by the authors above quoted. This extends from the wooded islands of Tierra del Fuego to the cordilleras, in Peru. Going in herds sometimes containing hundreds of individuals, they are generally shy and extremely wary, though sometimes, like the American antelope, their curiosity gets the better of their discretion, and they will approach the sportsman, if he lies on the ground and kicks up his feet in the air, holds up a handkerchief, or otherwise attracts their attention.

The Guanaco of Chile has usually been considered to be the Llama of Peru in a wild state. As above remarked, however, Tschudi makes them different species.

Note by Lieut. Gilliss.—"The Guanaco may be found on the entire Andean chain, in Chile, and is certainly the most abundant of the larger quadrupeds. It attains maturity in rather less than one year, but continues slowly increasing in size during several years. As they feed just below the snow-line, and the young are less fleet than full grown animals, the

former are easily captured by the muleteers, who bring down snow, and may frequently be purchased in the streets of Santiago during the months of November and December. At that time they are from two to three months old; are very gentle; will follow one about the house within a day or two, and soon learn to drink milk voraciously. Their bleat is not unlike that of the young goat. As they grow older they are less docile; are very easily displeased, and will strike the offender with all four feet at once, or eject an acrid saliva at him from a distance of several feet. At this time they are fond of barley, other small grain, bread, and most green food, preferring, however, alfalfa, or the young barley straw.

"It is difficult to raise them—or at least it is difficult to do so in Santiago—perhaps because of the heat on the plain at the time they are brought from a much colder atmosphere, and the difficulty of properly regulating their food. Four died, notwithstanding the care and attention of our household, aided by the counsels of those who should have been most likely to afford good advice; one, a full-grown female, which had been raised in captivity and subsequently came into my possession, became so violent in the rutting season that it was necessary to remove her from the premises of the gentleman who had her in charge. No attacks were ever made on him; but whenever his wife came near, the Guanaca would spring at her with all four feet drawn together.

"In a state of nature, one male presides over a herd of females sometimes twenty in number. They are occasionally driven nearly to the plain by heavy falls of snow, and then guasos hunt them for their skins. The hunters assemble in a body with a troop of dogs and surround the herd, driving it, if possible, into a ravine with very steep walls, and there, by means of lassos or bolas, the animals are quickly taken. Large numbers are often captured in this way, their skins being worth about half a dollar each. In Patagonia the Indians destroy great numbers of young, whose skins they dress with considerable skill and then sew neatly together, forming soft and pretty robes, which find ready purchasers in the markets both at Buenos Ayres and Valparaiso. The meat was never offered for sale at Santiago."

The following interesting account of the habits of the Guanaco, from personal observation, has been furnished by Lieutenant Phelps:

"It affords me pleasure to comply with your request, and give you such points as I observed of the habits of the Guanaco and of their favorite haunts, premising, however, that they will be limited, and dependant entirely upon memory of casual observations.

"I made hunting expeditions of some length into the cordillera in the summer and fall months; and as the snow-line varies very much during these, the Guanacos were found at quite different elevations, though generally near the snow, and were often seen far above its lower limits. In midsummer they are found considerably below this, though I did not find them near so low as the upper limit of the growth of small trees and bushes that in places cover the slopes of the mountains quite densely. It seemed that they have about the same grounds for their principal ranges, descending temporarily from them, according to the quantity and limits of snow. In the south of Chile, and upon the eastern slope of the Andes, they are found low down in valleys, upon the plains, about lakes and streams, &c.; but in the portion of the mountains visited by me, I did not know or hear of their descending from high elevations, except during severe storms, when they go down in great numbers to the plains, but retire to their accustomed haunts immediately after it ceases.

"It was a matter of surprise how such numbers could thrive where there appeared to be so very little vegetation. In the small and watered valleys, or basins, there is a coarse growth of sedge-grass, and elsewhere mosses, &c. I saw them frequently feeding upon moss-covered knolls cropping out from beds of frozen snow.

"They are found in herds of hundreds, in small numbers, in pairs, and singly—this last but rarely. When startled, especially if in numbers, they bleat an alarm very singular, and heard

to a considerable distance. It is a prolonged bleat, and metallic in its tone. This I heard only when they were alarmed.

"When I first went into the mountains—in company with a haciendado and a number of his peons, who were going up to collect and drive down the cattle that range in summer upon very elevated plains—the men amused themselves very much at the idea of shooting Guanacos, particularly with the little rifle I had with me, because, they said, 'they were very wild, and though they might not see one approaching them, they could smell the hunter a mile off;' but after that expedition I had no difficulty in finding plenty of the same men ready to follow me on a hunt; for with their mules they brought down the flesh so quickly dried in those altitudes, and they frequently met with valuable prizes in the bezoars found in the stomachs of the animals, and which the druggists purchase.

"The sight of the Guanaco is marvellously quick and clear, and their sense of smell wonderful. At distances of one, two, and even three miles I have startled droves of them from their feeding-grounds, myself only able to see them upon some distant ridge by the projection of their forms upon the deep blue of the sky as a back-ground. When so seen, with their fronts towards one and head erect, they look like the cactus stalks common upon the nearly barren hills below. At such times they frequently started off upon a fleet gallop, which I soon learned to regard as a sign that it were folly to pursue them. When startled by sudden appearance of danger, the character of which they have discovered by sight or scent, they run at great speed, selecting generally the most inaccessible ways—running with ease along the side of a mountain ridge or ledge where a person exceedingly expert in such footing would find it difficult to walk at all. The earthquakes have caused the spreading out of beds of small and angular stones upon the mountain sides to such an extent as to peril the footman's life; and during the tremors of the earth, these rattle down in a way desirable to witness only at a safe distance. Over such beds, whether up or down, or along the hill-side, the Guanaco runs with ease and speed. When struck by a ball, I observed they invariably sprang over the ledges, or down the precipitous banks of gorges—as it was in such places that I found it possible to approach them—and sometimes these leaps were frightful to witness. One shot through the heart went over a rocky wall of six hundred feet in height, as estimated by the party. Firing across a chasm once, my person completely hidden by rocks, I made three shots before the flock took to flight, and then one, being struck, plunged down into the deep gorge, the others following. The report of the rifle appeared to be strange, and to excite the utmost curiosity; but in general I did not see this trait having the effect to overcome timidity, and found, to my experience, that their instinct of flight overcame the weakness, and sent them at least to the most prominent neighboring height before they stopped to indulge it. In regions rarely visited by man, no doubt they are less timid, and display more of the curiosity I heard attributed to them. The eye, in their wild state, is exceedingly beautiful—large, black, clear, and soft as the Gazelle's. This particularly excited my attention when a drove approached from windward (a strong wind blowing) to within a few feet of me, where they stopped alarmed, and, raising their heads to their utmost height, gazed intently at the rocks among which I had hidden myself, taking care to find a crack through which I could see the trail that I had anticipated their taking when disturbed at another point by the men.

"The affectionate solicitude for a wounded member of the troop that is attributed to them I never witnessed, except in cases where there were but two or three together; then the companions several times were quite reckless of danger. Where there were large numbers, they all invariably made off, regardless of the wounded. Nor did I observe anything like the absolute leadership and control of the troop, related as being exercised by a hardy and veteran male, and the battles described as taking place among the males. Contests, involving this sole control and leadership of a large number of females herded together, I never witnessed, nor anything corroborative of it, though it may be entirely true. I have already stated having

found them in numbers from one to hundreds. The guasos did not relate having themselves witnessed these contests.

"Though the times of my visits to the mountains ranged through several months of the year, I cannot determine what is their season of bearing young; for I found them at all times, of every size and apparent age, from the recent born to the veteran of the herd, whose woolly covering had been bleached to an almost snowy white by the storms and tempests of many winters.

"The Guanaco does not range indiscriminately over the Chilean Andes, but has favorite haunts which it never forsakes; and there are extensive regions where it is never found.

"The common people of the country hunt them by forming rodeos—that is to say, numbers go into the mountains, and having formed a large circuit about some place previously selected as favorable for the purpose, they gradually drive all the animals within the circuit towards this, and closing up, finally have them surrounded at close quarters, more often floundering in the deep snow at the bottom of a ravine, the passes from which are blocked up, where they fall an easy prey, and are killed by dogs, lassos, &c. These people dry the meat, use the skins, and sell the bezoars. I have tried the flesh, and though not partial to it, could live upon it if hard pushed."

LIST OF MAMMALIA FOUND IN CHILE.

CHEIROPTERA.

INSECTIVORA.

STENODERMA, Geoff.

chilensis, Gay.—Hab. Very rare in Chile.

Stenoderma chilensis, Gay, Hist. Chile, Zoologia, I, 1847, 30, Lam. i.

DESMODUS, Max.

d'orbignyi, Waterh.—Hab. Northern provinces of Chile.

Desmodus d'orbignyi, Waterhouse, Zool. of Beagle, Mamm. 1838, 1, Pl. i and xxxv, f. 1.

Gay, Hist. Chile, Zool. I, 1847, 33.

DYSOPES, Temm.

nasutus, Temm.—Hab. South America generally.

Dysopes nasutus, Temm. Mon. Mamm. 1, 233.

Waterhouse, Zool. of Beagle, Mamm. 1838, 6.

Molossus nasutus, Spix. Sim. et Vespert. Bras. 60.

Gay, Hist. Chile, Zool. I, 1847, 35.

NYCTICEJUS, Raf.

varius, Schinz.—Hab. Central Chile.

Nycticejus varius, Schinz. Syn. Mamm. I, 1844, 199.

Gay, Hist. Chile, Zool. I, 1847, 37.

Vulg. *Murcielago colorado.*

macrotis, Fisch.—Hab. Santiago to Araucania.

Nycticejus macrotis, Schinz, Syn. Mamm. I, 1844, 199.

Gay, Hist. Chile, Zool. I, 1847, 38.

VESPERTILIO, L.

velatus, Fisch.—Hab. Near Santiago.

Vespertilis velatus, Fischer, Synopsis Mamm. 1829, 118.

Gay, Hist. Chile, Zool. I, 1847, 40, Lam. i.

Plecotus velatus, Geoff. Mag. Zool. 1832.

Vulg. *Orejudo.*

chiloensis, Waterh.—Hab. Chilóe.

Vespertilio chilóensis, Waterh. Zool. of Beagle, Mamm. 1838, 5, Pl. iii.

Gay, Hist. Chile, Zool. I, 1847, 42, Lam. i.

RAPACIA.

Fam. CARNIVORA.

FELIDÆ.

FELIS, L.

concolor, L.—Hab. South America generally.
Felis concolor, L. Mantissa, 1771, 522, Pl. ii.
Gay, Hist. Chile, Zool. I, 1847, 65.
Aud. and Bach. N. Am. Quad. II, 1851, 305, Pl. xcvi, xcvii.
Burmeister, Thiere Brasiliens, I, Mamm. 1854, 88.
Vulg. *Panther, Cougar, Puma, Leon.*

pajeros, Desm.—Hab. Chile, Paraguay, and Patagonia.
Syn. *Felis pajeros*, Desm. Mamm. 1820–1822, 231.
Waterhouse, Zool. of Beagle, Mamm. 1838, 18, Pl. ix.
Gay, Hist. Chile, Zoologia, I, 1847, 69, Pl. iv.
Chat pampa, Azara, Hist. Nat. Par. I, 1801, 179.
Vulg. *Guiña, Pampa Cat.*

guigna, Mol.—Hab. Chile.
Syn. *Felis guigna*, Mol. Saggio, 1782, 295.
Gay, Hist. Chile, Zool. I, 1847, 70.
Vulg. *Guiña.*

colocolo, Mol.—Hab. Chile and Guiana?
Syn. *Felis colocolo*, Mol. Saggio, 1782, 295.
Gay, Hist. Chile, Zool. I, 1847, 71.
Vulg. *Colocolo.*

Fam. CANIDÆ.

CANIS, L.

fulvipes, Martin.—Hab. Chilóe and the Chonos Archipelago.
Syn. *Canis fulvipes*, Martin, Pr. Zool. Soc. Lond. 1837, 11.
Waterhouse, in Zool. of Beagle, I, 1838, 12, Pl. vi.
Gay, Hist. Chile, I, 1847, 58.
Canis lagopus, Molina.
Vulg. *Zorra, Paineguru.*

magellanicus, Gray.—Hab. Chile and Patagonia.
Syn. *Canis magellanicus*, Gray, Pr. Zool. Soc. Lond. IV, 1836, 88.
Waterhouse, Zool. of Beagle, Mamm. 1838, 10, Pl. v.
Gay, Hist. Chile, Zool. I, 1847, 59.
Vulpes magellanicus, Gray, Mag. Nat. Hist. I, 1837, 578.
Vulg. *Culpeu.*

azaræ, Max.—Hab. Chile, La Plata, and Patagonia.
Syn. *Canis azaræ*, Max. Naturg. Brasiliens, II, 1826, 338.
Waterhouse, Zool. Beagle, Mam. 1838, 14, Pl. vii.
Gay, Hist. Chile, Zool. I, 61.
Canis (Lycalopex) azaræ, Burm. Thiere Bras. I, 1854, 96.
Agouarachay, Molina, Essais. 317.
Vulg. *Chilla.*

Fam. MUSTELIDÆ.

a MARTINÆ.

GALICTIS, Bell.

vittata, Bell.—Hab. Guiana, Brazil, and Chile, to Patagonia.
Syn. *Viverra vittata,* Schreber, Saügt. III, 447, Tab. 124.
Gm. Syst. Nat. I, 1788, 89.
Gulo vittatus, Desm. Mamm. 175.
Ursus Brasiliensis, Thunb. Mem. Ac. St. Pet. VI, 401, Tab. xiii.
Galictus vittata, Bell, Zool. Jour. II, 251.
Ib. Trans. Zool. Soc. Lond. II, 203, Tab. xxxv.
Gay, Hist. Chile, Zoologia, I, 1847, 51.
Burmeister, Thiere Brasiliens, I, 1854, 109.
Le Grison, Buff. XV, 65, Tab. viii.
Vulg. *Grison. Huron. Quique,* (Chile,) *Cachorino de Mato,* (Braz.)

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b MELINÆ.

MEPHITIS, Cuv.

chilensis, ——.—Hab. Northern and Central Chile.
Syn. *Mephitis chilensis,* St. Hilaire.
Licht. Berl. Abh. 1838, 272.
Gay, Hist. Chile, Zoologia, I, 1847, 49.
Mephitis furcata, Wagner, Suppl. Schreber, II, 1841, 192.
Vulg. *Chingue. China. Skunk.*

patagonica, Licht.—Hab. Patagonia and Southern Chile.
Syn. *Mephitis patagonica,* Licht. Abh. Berl. 1838, 275.
Gay, Hist. Chile, Zool. I, 1847, 50.
Conepatus humboldtii, Gray, Loudon's Mag. I, 581.

? molinæ, Licht.—Hab. Chile.
Syn. *Mephitis molinæ,* Licht. Abh. Berl. 1838.
Viverra chinga, Molina, Saggio, 240.
Obs. This is a very doubtful species.

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c LUTRINÆ.

LUTRA, Ray.

felina, Gay.—Hab. Coast of Chile.
Sup. *Mustela felina,* Mol. Saggio, 1782, 330.
Lutra felina, Gay, Hist. Chile, Zoologia, I, 1847, 45, Lam. ii.
Lutra chilensis, Benn. Pr. Com. Zool. Soc. Lond. 1832, 1.
Waterhouse, Zool. of Beagle, Mamm. 1838, 22.
Vulg. *Gato del Mar. Nutria. Chinchimen. Chungungo. Otter.*

huidobria, Gay.—Hab. Colchagua to Valdivia.
Syn. *Castor huidobria,* Molina, Saggio, 321.
Lutra huidobria, Gay, Hist. Chile, Zool. I, 1847, 47.
Vulg. *Guillin. Otter.*

Sub Order PENNIPEDIA.

Fam. PHOCIDÆ.

OTARIA, Per.

porcina, Desm.—Hab. Coast of Chile.
Syn. *Phoca porcina,* Molina, Saggio, 260.
Otaria porcina, Desm. Nouv. Dict. XXV, 602.
Gay, Hist. Chile, Zoologia, I, 1847, 75.
Vulg. *Lobo del Mar.*

jubata, Desm.—Hab. Coast of Chile.
Syn. *Phoca jubata,* Schreb. Saügt. 300.
Otaria jubata, Desm. Mamm. 248.
Gay, Hist. Chile, Zoologia, I, 1847, 75.
Vulg. *Leon Marino.*

flavescens, Desm.—Hab. Coast of Chile.
Syn. *Phoca flavescens,* Shaw, Gen. Zool. I, 1800, 260.
Otaria flavescens, Desm. Mamm. 252.
Schinz, Syn. Mamm, I, 1844, 475.
Otaria molossina, Less. and Garnet, Bull. des Sc. Nat. VIII.
Gay, Hist. Chile, Zoologia, I, 1847, 77.

ursina, Desm.—Hab. Coast of Chile.
Syn. *Phoca ursina,* Linn. Syst. Nat. ed. 12, I. 1766, 55.
Otaria ursina, Desm. Mamm. 249.
Gay, Hist. Chile, Zoologia, I, 1847, 78.
Arctocephalus ursinus, F. Cuv. Dict. des Sc. Nat. XXXIX, 554.
Vulg. *Sea Lion. Sea Bear.*

STENORHYNCHUS, F. Cuv.

leptonyx, F. Cuv.—Hab. Southern Pacific Ocean.
Syn. *Phoca leptonyx,* Blainv. Jour. de Phys.
Stenorhynchus leptonyx, F. Cuv. Dict. des Sc. Nat. XXXIX, 549.
Gay, Hist. Chile, Zoologia, I, 1847, 79.
Phoca homei, Less. Dict. Class XIII, 417.

MACRORHINUS, F. Cuv.

leoninus.
Syn. *Phoca leonina,* L. Syst. Nat. I, 1766.
Fischer, Synopsis Mamm. 1829, 234.
Phoca proboscidea, Desm. Mamm. 1820–'22, 238, 368.
Macrorhinus proboscideus, F. Cuv. Dict. des Sc. Nat. XXXIX, 552.
Gay, Hist. de Chile, Zoologia, I, 1847, 80.
Vulg. *Elefante del mar. Sea Lion. Sea Elephant.*

MARSUPIALIA.

DIDELPHYS, L.

elegans, Waterh.—Hab. Central Provinces of Chile.
Syn. *Didelphys elegans,* Waterh. Zool. of Beagle, Mammalia, 1839, 95, Pl. xxxi.
Ib. Nat. Hist. Mamm. I, 1846, 515, Pl. xvi, fig. 1.
Gay, Hist. Chile, Zoologia, I, 1847, 84.

Didelphys hortensis, Reid, Pr. Zool. Soc. Lond. V, 1837, 4.
Thylamys elegans. Gray, List Mamm. Br. Mus. 1843, 101.
Vulg. *Comadreja*, *Llaca*.

RODENTIA.

Fam. HYSTRICIDÆ.

CAVIINÆ.

CAVIA, Erx.

australis, Is. Geoff.—Hab. Andes, from Lat. 33° S. to Patagonia.
Syn. *Cavia australis*, Is. Geoff. Mag. de Zool. III, 1833, Pl. xii.
Waterhouse, Nat. Hist. Mamm. II, 1848, 180, Pl. iv.
Kerodon kingii, Benn. Pr. Zool. Soc. Lond. III, 1835, 190.
Waterhouse, Zool. of Beagle, Mamm. 1839, 88.
Vulg. *Mountain Rabbit.*

CHINCHILLINÆ.

LAGIDIUM, Meyen.

cuvieri, Wagn.—Hab. Andes of Chile, Peru, and Bolivia.
Syn. *Lagotis cuvieri*, Benn. Pr. Zool. Soc. Lond. May, 1833.
Ib. Trans. Zool. Soc. Lond. I, 46, Pl. iv.
Lagidium cuvieri, Wagner, Suppl. Schreber, III, 1843, 306.
Waterhouse, Nat. Hist. Mamm. II, 1848, 222, Pl. vii.
?Lagidium peruanum, Meyen. Nova Acta Acad. K. L. C. XVI, 578.
?Callomys aureus, Geoff. D'Orb. Ann. des Sc. Nat. XXI, 1830, 291.
Vulg. *Biscacha*, or *Viscacha*.

criniger, Gay.—Hab. Colchagua.
Syn. *Lagotis criniger*, Gay, Hist. Chile, Zool. I, 1848, 92, Lam. v, vi.
Lepus viscacha, Molina, Saggio, 348.
Vulg. *Biscacha*, or *Viscacha*.

pallipes, Wagner.—Hab. Andes of Chile and Peru.
Syn. *Lagotis pallipes*, Bennet, Pr. Zool. Soc. Lond. III, May, 1835, 67.
Ib. Trans. Zool. Soc. Lond. I, 331, Pl. xlii.
Gay, Hist. Chile, Zoologia, I, 1847, 95.
Lagidium pallipes, Wagner, Suppl. Schreber, Saüght, III. 1843, 308.
Tschudi, Fauna Peruana, 1845, 165.
Waterhouse, Nat. Hist. Mamm. II, 1848, 228.
Vulg. *Biscacha*, or *Viscacha*.

CHINCHILLA, Benn.

lanigera, Benn.—Hab. Northern Chile and Bolivia.
Syn. *Mus laniger*, Molina, Saggio, 1789, 267.
Callomys laniger, Gfoff. and D'Orb. Ann. des Sc. Nat. 291.
Chinchilla lanigera, Benn. Garden's Monog. Zool. Soc. Lond. I, 1.
Ib. Trans. Zool. Soc. I, 59.
Waterhouse, Nat. Hist. Mamm. II, 1848, 236.
Chinchilla laniger, Gay, Hist. Chile, Zool. I, 1847, 90.
Vulg. *Chinchilla*.

OCTODONTINÆ.

HABROCOMA, Waterh.

bennetti, Waterh.—Hab. Central Provinces of Chile.

Syn. *Abrocoma bennetti*, Waterh. Pr. Zool. Soc. Lond. 1837, 31.
Ib. Zool. of Beagle, Mamm. 1839, 85, Pl. xxviii.
Gay, Hist. Chile, Zool. I, 1847, 97.
Habrocoma bennetti, Waterh. Nat. Hist. Mamm. II, 1848, 248, Pl. vii, f. 2.
Habrocoma helvina, Wagner, Wiegm. Archiv. 1842.

cuvieri, Waterh.—Hab. Near Valparaiso.

Syn. *Abrocoma cuvieri*, Waterh. Pr. Zool. Soc. Lond. 1847, 32.
Ib. Zool. of Beagle, Mammalia, 1839, 86, Pl. xxix.
Gay, Hist. Chile, Zoologia, I, 1847, 98.
Habrocoma cuvieri, Waterh. Nat. Hist. Mamm. II, 1848, 251.

OCTODON, Benn.

degus, Waterh.—Hab. Central Chile.

Syn. *Saurus degus*, Molina, Saggio, 1782, 303, 342.
Dendrobius degus, Meyen. Acta Acad. K. L. C. XVI, 1833, 601, Pl. xliv.
Octodon degus, Waterh. Nat. Hist. Mamm. II, 1848, 253, Pl. xi, fig. 2.
Octodon cumingii, Benn. Pr. Zool. Soc. II, 1832, 47.
Ib. Trans. Zool. Soc. Lond. II, 81, Pl. xvi.
?Tschudi, Fauna Peruana, 171, Pl. xii.
Gay. Hist. Chile, Zoologia, I, 1847, 99.
Vulg. *Bori*, *Degu*.

bridgesii, Waterh.—Hab. Colchagua.

Syn. *Octodon bridgesii*, Waterhouse, Pr. Zool. Soc. Lond. 1844, 153.
Gay, Hist. Chile, Zoologia, I, 1847, 101.
Waterhouse, Nat. Hist. Mamm. II, 1848, 259.

SCHIZODON, Waterh.

fuscus, Waterh.—Hab. Andes of Chile.

Syn. *Schizodon fuscus*, Waterh. Pr. Zool. Soc. Lond. 1841, 91.
Gay, Hist. Chile, Zoologia, I, 1847, 102.
Waterhouse, Nat. Hist. Mamm. II, 1848, 265, Pl. xi, fig. 2.

SPALACOPUS, Wagler.

pœppigii, Wagler.—Hab. Chile, Copiapó to Cauquenes.

Syn. *Spalacopus pœppigii*, Wagler, Isis, 1832, 1219.
Waterh. Nat. Hist. Mamm. II, 1848, 269, Pl. ix, f. 1.
Pœphagornys ater, F. Cuv. Ann. des Sc. Nat. 2d ser. I, 1834, 321, Pl. xxi.
Waterh. Zool. of Beagle, Mamm. 1839, 82.
Eydoux and Gerv. Favorite, V, Zool. 1839, 17, Pl. vii.
Psammoryctes noctivagus, Pœppig in Wiegm. Archiv. I, 1835, 252.
?Mus cyanus, Molina, Saggio, 1782, 308.
Vulg. *Cururo*. *Curucho*.

CTENOMYS, Blainv.

magellanicus, Benn.—Hab. Straits Magellan. Chile?

Syn. *Ctenomys magellanicus*, Benn. Pr. Zool. Soc. Lond. 1836, 190.
Ib. Trans. Zool. Soc. II, 84, Pl. xvii.
Gay, Hist. Chile, Zoologia, I, 1847, 106.
Waterhouse, Nat. Hist. Mamm. II, 1848, 283, Pl. ix, f. 2.

ECHYMYINÆ.

MYOPOTAMUS, Geoff.

coypus, Commers.—Hab. Chile, Peru, and Brazil, to Patagonia.
Syn. *Mus coypus*, Molina, Saggio, 1782, 287.
Myopotamus coypus, (Commers.) Geoff. Ann. du Mus. VI, 1805, 81.
Gay, Hist. Chile, Zoologia, I, 1847, 122.
Waterh. Nat. Hist. Mamm. II, 1848, 297, Pl. xv, f. 1.
Vulg. *Coypu. Nutria.*

MURIDÆ.

MURINA.

OXYMICTERUS, Waterh.

scalops, Gay.—Hab. Central Chile.
Syn. *Oxymicterus scalops*, Gay, Hist. Chile, Zoologia, I, 1847, 108, Lam. vi.

megalonyx, Gay.—Hab. Quintero, Central Chile.
Syn. *Hesperomys megalonyx*, Waterh. Pr. Zool. Soc. Lond. 1844, 154.
Oxymicterus megalonyx, Gay, Hist. Chile, Zoologia, I, 1847, 109.

HESPEROMYS, Waterh.

longipilis, Waterh.—Hab. Central and Northern Chile.
Syn. *Mus longipilis*, Waterh. Zool. of Beagle, Mammalia, 1839, 55, Pl. xvi.
Gay, Hist. Chile, Zoologia, I, 1847, 113.
Hesperomys longipilis, Waterh. l. c.

renggeri, Waterh.—Hab. Near Valparaiso.
Syn. *Mus olivaceus*, Waterh. Pr. Zool. Soc. Lond. 1838, 16.
Mus renggeri, Waterh. Zool. of Beagle, 1839, 51, Pl. xv, f. 1.
Gay, Hist. Chile, Zoologia, I, 1847, 114.
Hesperomys renggeri, Waterh. l. c. 1839.

brachyotis, Waterh.—Hab. Chonos Archipelago.
Syn. *Mus brachyotis*, Waterh. Pr. Zool. Soc. Lond. 1837, 17.
Ib. Zool. of Beagle, Mamm. 1839, 115, Pl. xiv.
Gay, Hist. Chile, Zoologia, I, 1847, 115.
Hesperomys brachyotis, Waterh. l. c.

?rupestris, ——.—Hab. Chile.
Syn. *Mus rupestris*, Gervais, Voy. de la Bonite, I, 51.
Gay, Hist. Chile, Zoologia, I, 115, Lam. vi, vii.

xanthorhinus, Waterh.—Hab. Straits of Magellan.
Syn. *Mus xanthorhinus*, Waterh. Pr. Zool. Soc. Lond. 1837, 28.
Ib. Zool, of Beagle, 1839, 53, Pl. xvii, f. 1.
Gay, Hist. Chile, Zool. I, 1847, 116.
Hesperomys xanthopygus, Waterh. l. c. (part.)

darwinii, Waterh.—Hab. Province of Coquimbo.
Syn. *Mus darwinii*, Waterh. Pr. Zool. Soc. Lond. 1837, 28.
Ib. Zoology of Beagle, Mammal. 1839, 117.
Gay, Hist. Chile, Zoologia, I, 1847, 117.
Hesperomys darwinii, Waterh. l. c.

lutescens, Gay.—Hab. Central Provinces of Chile.
Syn. *Mus lutescens,* Gay, Hist. Chile, Zoologia, I, 1847, 118, Lam. vi, vii.

longicaudatus, Waterh.—Hab. Central Chile.
Syn. *Mus longicaudatus,* Benn. Pr. Com. Zool. Soc. Lond. 1832, 2.
Waterhouse, Zool. of Beagle, Mammalia, 1839, 39, Pl. xi.
Gay, Hist. Chile, Zoologia, I, 1847, 119.
Hesperomys longicaudatus, Waterh. l. c.

darwinii, Waterh.—Hab. Province of Coquimbo.
Syn. *Mus darwinii,* Waterhouse, Zool. of Beagle, Mamm. 1839, 64, Pl. xxiii.
Hesperomys darwinii, Waterh. l. c.

REITHRODON, Waterh.

chinchilloides, Waterh.—Hab. Straits of Magellan.
Syn. *Reithrodon chinchilloides,* Waterh. Zool. of Beagle, Mamm. 1849, 72, Pl. xxvii.
Gay, Hist. Chile, Zoologia, I, 1847, 120.

EDENTATA.

Sub Order EFFODIENTIA.

DASYPUS, L.

minutus, Desm.—Introduced in Chile from the pampas of Buenos Ayres.
Syn. *Dasypus minutus,* Desm. Encyclop. Meth. 371.
Gay, Hist. Chile, Zoologia, I, 1847, 131.
Vulg. *Quirquincho; Tato; Covur.*

CHLAMYPHORUS, Harl.

truncatus, Harl.—Hab. Mendoza, and probably the Chilean Cordilleras.
Syn. *Chlamyphorus truncatus,* Harl. Ann. N. Y. Lyceum, 1825.
Ib. Zool. Jour. II, 1825, 163.
Ib. Med. and Physical Researches.
Yarrell, Zool. Jour. III, 1827, 544, Pl. xvi, xvii.
Chlamydophorus truncatus, Wagner, Suppl. Schreber, Saügt. IV, 1844, 187.
Hyrtl. Sitzb. K. Ak. Wien; Math. Nat. XII, 1854, 79.
Vulg. *Pichiciego nocturno.*

RUMINANTIA.

Fam. CAMELIDÆ.

AUCHENIA, Ill.

llama, Desm.—Hab. Cordilleras of Chile.
Syn. *Auchenia llama,* Waterhouse, Zool. of Beagle, Mam. 1838, 26.
Lama guanaco, Gay, Hist. Chile, Zoologia, I, 1847, 153.
Vulg. *Guanaco.*

Fam. CERVIDÆ.

CERVUS, L.

pudu, Gerv.—Hab. Chile and Chiloe.

Syn. *Cervus pudu*, Gerv. Ann. des Sc. Nat. 1830.
Gay, Hist. Chile, Zoologia, I, 1847, 158, Lam. ix, x.
Cervs humilis, Bennet, Pr. Zool. Soc. Lond. 1831.
Vulg. *Venado, Pudu.*

chilensis, Gay.—Hab. Cordilleras of Chile.

Syn. *Cervus chilensis*, Gay and Gervais, Ann. des Sc. Nat. 1846.
Gay, Hist. Chile, Zoologia, I, 1847, 159, Lam. x, xi.
Vulg. *Güamul*, or *Hüemul.*

CETACEA.

Fam. DELPHINIDÆ.

DELPHINUS, L.

lunatus, Less.—Hab. Coast of Chile.

Syn. *Delphinus lunatus*, Less. Voy. de la Coquille, 182, Pl. ix, f. 4.
Gay, Hist. Chile, Zoologia, I, 1847, 175.
Vulg. *Tunina.*

albimanus, Peale.—Hab. Coast of Chile.

Syn. *Delphinus albimanus*, Peale, Mam. U. S. Ex. Ex. 1848.

Fam. PHYSETERIDÆ.

PHYSETER, L.

macrocephalus, L.—Hab. Coast of Chile.

Syn. *Physeter macrocephalus*, *L.* Syst. Nat. 1766.
Gay, Hist. Chile, Zoologia, I, 1847, 177.
Vulg. *Cachalot: Sperm Whale.*

Fam. BALÆNIDÆ.

BALÆNA, L.

antarctica, Klein.—Hab. Coast of Chile.

Syn. *Balæna antarctica*, Gay, Hist. Chile, Zoologia, I, 1847, 181.
Vulg. *Right Whale.*

Obs.—I have omitted the synonomy of this species, not being able clearly to refer it to those of other authors than Gay.

BIRDS.

BY J. CASSIN.

Order I. RAPTORES.

SARCORAMPHUS GRYPHUS, (Linn.)

Vultur gryphus, Linn. Syst. Nat. I, 1766, 121.
Vultur magellanicus, Shaw, Mus. Lev. 1792, 1.
Vultur condor, Shaw, Gen. Zool. VII, 1809, 2.
Sarcoramphus condor, Less. Gay, Fauna Chilena, Aves, 194.
Vulg. *Condor, Condoro, and Buitre*, of the Chileans.
Figures.—Bonap. Am. Orn. IV, Pl. xxii.
" Temm. Pl. col. 133, 408, 464.
" Humb. Obs. Zool. Pl. viii.
" Voy. Bonite Zool. Pl. ii.
" Shaw, Mus. Lev. Pl. i.

Of six specimens in the collection, all those labelled as females bear a close resemblance to the males, but are invariably smaller. The colors are the same, though of somewhat duller shades, but not brown, as stated by Molina, though the present specimens corroborate his statement respecting the relative sizes of the sexes of this species. ("La femmina è inferiore in tutte le sue parti al maschio, e di color bruno."—Saggio sulla Storia Naturale del Chili, p. 224, second edition, quarto; Bologna, 1810.)

This bird, the largest of the family of Vultures, is abundant in nearly all parts of Chile, and particularly in the valleys of the Andes. The brown plumage alluded to above is that of the young bird.

Relating to this celebrated bird, we find the following in the notes which have been kindly placed at our disposal by Lieutenant Gilliss: "Males are distinguishable from females by a prominent caruncle, almost as marked as in the domestic cock. When young, the plumage is downy and bluish black, and the circlet around the neck at that time is very little different in color from the adult. Between the age of one and two years, the down nearly all disappears, but the bird remains near the nest, I was informed, until quite two years old. I saw two in Santiago that had been there more than a year, and were still unable to fly. As the birds grow older the wing and back feathers gradually become of brown or ashy gray, and the age may be known by the extent and brightness of the lighter colored plumage."

CATHARTES JOTA, (Molina.)

Vultur jota, Mol. Sagg. Stor. Nat. Chile, 1782.
Cathartes aura, Illig. Gay, Fauna Chilena, Aves, 202.
Vulg. *South American Turkey Vulture. Jote.*
Figures.—Vieill, Gal. des Ois. I, Pl. iv?

This species, though nearly related to the North American *Cathartes aura*, constantly presents characters very probably sufficient to constitute specific distinction. It is apparently, or so far as can be ascertained from prepared specimens, a more slender bird, and longer in all its measurements. The last character is particularly applicable to the wings.

Of several specimens of this Vulture in the collection of the Expedition, those labelled as females are invariably the smaller. This character distinctive of the sexes we are disposed to regard as prevailing throughout the family of Vultures, as previously mentioned by us, in "Illustrations of the Birds of California and Texas," I, p. 113; in this respect differing from the family Falconidæ, in which the female is the larger.

This Vulture is of common occurrence in Chile, and resorts to the seacoast in large numbers for the purpose of feeding on dead fishes and other marine animals.

CATHARTES ATRATUS, (Bartram)

Vultur atratus, Bartram, Travels, 1791, 289.
Vultur urubu, Vieill. Ois. d'Am. Sept. 1807, 53, Pl. ii.
Cathartes urubu, (Vieill.) Gay, Fauna Chilena, Aves, 200.
Vulg. *Black Vulture. Jotecillo. Gallinazo.*
Figures.—Wilson, Am. Orn. IX, Pl. lxxv, Fig. 2.
" Aud. B. of Am. Pl. cvi; oct. ed. I, Pl. iii.

A single specimen in mature plumage and excellent condition is exactly identical in size and other characters with the common species of the southern parts of North America. It is the only specimen presenting this similarity that we have ever seen from South America, and is larger and in other respects different from the allied *Cathartes brasiliensis*, which is an inhabitant also of that division of this continent.

This species is not abundant in Chile, though represented to be occasionally met with in the interior.

POLYBORUS THARUS, (Molina.)

Falco tharus, Molina, Sagg. Stor. Nat. del Chile, 1782.
Falco cheriway, Jacquin, Beytr. Gesch. der Vög. 1784, 17.
Falco brasiliensis, Gmelin, Syst. Nat. I, 1788, 262.
Polyborus vulgaris, Vieill. Nouv. Dict. V, 1816, 257.
Caracara vulgaris, (Vieill.) Gay, Fauna Chilena, Aves, 207.
Vulg. *Caracara Eagle. Traro.*
Figures.—Jacquin, Vog. Pl. iv.
" Vieill. Gal. I, Pl. vii.
" Spix. B. of Birds, I, Pl. i.
" Aud. B. of Am. Pl. clxi; oct. ed. I, Pl. iv.
" Swainson, Zool. Ill. I, Pl. ii.
" Gay's Chile, Orn. Pl. i.

Abundant, and for the greater part exhibiting the characters of a Vulture.

Lieutenant Gilliss observes of this bird: "Exceedingly numerous throughout central and southern Chile. It is constantly found along the roads and wherever there is a chance of obtaining a particle of flesh or offals. At the annual slaughtering of cattle, they congregate by hundreds, and remain without the *corral* awaiting their share of the rejected parts. It is so tame from being little molested, that it may be taken with the lasso, but when captured will fight desperately. When provoked in captivity it utters a noise not unlike that of the male Turkey, though much more shrill, and ends by throwing the head back, closing the eyes in impotent wrath. No amount of kindness or attentive treatment reconciles it to deprivation of liberty."

MORPHNUS UNICINCTUS, (Temm.

Falco unicinctus, Temm. Pl. col. I, 1827.
Falco Harrisii, Aud. Orn. Biog. V, 1839, 30.
Polyborus tæniurus, Tschudi, Wiegm. Archiv. X, 1844, 263.
Buteo unicinctus, (Temm.) Gay, Fauna Chilena, Aves, 216.
Vulg. *Red-winged Hawk. Peuco.*
Figures.—Temm. Pl. col. 313.
" Aud. B. of Am. Pl. 392; oct. ed. I, Pl. 5.
" Tschudi, Fauna Peruana, Orn. Pl. 1.

Of this fine species, which is of common occurrence in Chile, Peru, and other countries of western South America, and in Mexico, and of interest to the student of North America from the fact that it has been met with also in Texas and Louisiana, numerous specimens of adults and young birds are in the collection. The adult plumage is well represented in the plates of Temminck and Audubon, as cited above.

The young bird presents very considerable differences from the adult, though in all the specimens that we have seen preserving more or less of the fine rufous of the large patch on the shoulder or wing-coverts. The inferior parts of the body, instead of being of a clear and uniform dark brown, are striped longitudinally with dark brown and yellowish white, every feather having a central stripe of the former and edged with the latter. In some specimens there are transverse stripes of white on the abdomen. The plumage of the upper parts is more or less edged with rufous.

In Mexico and Texas this bird is partial to the neighborhood of rivers, and is dull and sluggish in its general habits.

MILVAGO CHIMANGO, (Vieill.)

Polyborus chimango, Vieill. Nouv. Dict. V, 1816, 260.
Aquila pezopora, Meyen, Nov. Acta XVI, Supp. 1834, 62.
Caracara chimango, (Vieill.) Gay, Fauna Chilena, Aves, 211.
Vulg. *Tiuque.*
Figures.—Gray, Genera of Birds I, Pl. v.
" Nov. Acta Acad. Breslau XVI, Supp. Pl. vi.

Very abundant in Chile and other countries of western South America.

Lieutenant Gilliss observes: "Associated with, and has the same general, though much more sluggish habits than the *Traro* (*Polyborus tharus.*) In Chile it may be found on all the plains west of the Andes. At times it will scarcely get out of the road for a horseman."

PONTOÆTUS MELANOLEUCUS, (Vieill.)

Spizœtus melanoleucus, Vieill. Nouv. Dict. XXXII, 1818, 57.
Falco aquia, Temm. Pl. col. I, (not paged.)
Pontoœtus melanoleucus, (Gray,) Gay, Fauna Chilena, Aves, 221.
Vulg. *Aguila.*
Figure.—Temm. Pl. col. I, Pl. cccii.

Represented as rare, and inhabiting the mountains.

BUTEO ERYTHRONOTUS, (King.)

Haliætus erythronotus, King, Zool. Jour. III, 1827, 424.
Buteo tricolor and *unicolor*, D'Orb. et Lafres, Guérin's Mag. 1837, 6, 7.
Buteo erythronotus, (Gould,) Gay, Fauna Chilena, Aves, 215.
Vulg. *Red-backed Buzzard. Aguilucho.*
Figures.—D'Orb. Voy. l'Am. Mer. Birds, Pl. iii, Figs. 1, 2.

This, in its adult plumage, is one of the handsomest of the Rapacious birds. It extends its range over the greater part of South America, but is not common in Chile.

ELANUS LUCURUS, (Vieill.)

Milvus lucurus, Vieill. Nouv. Dict. XX, 1818, 563.
Falco dispar, Temm. Pl. col. I, about 1824.
Elanus dispar, (Temm.) Gay, Fauna Chilena, Aves, 33.
Vulg. *White-tailed Hawk. Bailarin.*
Figures.—Bonap. Am. Orn. II, Pl. xi, Fig. 1.
" Temm. Pl. col. I, Pl. cccxix.
" Aud. B. of Am., Pl. ccclii ; oct. ed. I, Pl. xvi.
" Gay's Chile, Orn. Pl. ii.

Several specimens of this handsome bird are precisely identical with others, to which we have referred for comparison, from the southern States of this Union. This species has therefore an extensive range of locality, embracing the southern portion of the United States, Mexico, Central America, and the countries of western South America. In Lieut. Gilliss's notes we find the following: "Quite numerous. The nest is composed of small sticks, and the female lays from four to six eggs, of a dirty yellowish white, with brownish spots. Its vulgar name is derived from *bailar*, to dance or balance, from the easy and graceful manner in which the bird seems almost to float upward or sink through the air."

CIRCUS CINEREUS, Vieill.

Circus cinereus, Vieill. Nouv. Dict. IV, 1816, 454.
Falco histrionicus, Quoy and Gaim. Voy. Uranie, Zool. 1824, 93.
Circus cinereus, (Vieill.) Gay, Fauna Chilena, Aves, 239.
Vulg. *Nebli.*
Figures.—Quoy and Gaim, Voy. Uranie, Zool. Atlas, Birds, Pl. xv, xvi.

This handsome Harrier is common in Chile, and preys on small quadrupeds, reptiles, and insects.

CIRCUS MACROPTERUS, Vieill.

Circus macropterus, Vieill. Nouv. Dict. IV, 1816, 458.
Falco palustris, De Wied, Beitr. zur Nat. Bras. III, 1830, 224.
Circus superciliosus, Sess. Traité d'Orn. I, 1831, 87.
Figure.—Temm. Pl. col. I, Pl. xxii.

Of rare occurrence in Chile, though represented as abundant in other parts of South America.

FALCO NIGRICEPS, Cassin.

PLATE XIV.

Falco nigriceps, CASSIN, Birds of California and Texas I, 1853, 87.

DESCRIPTION.—Very similar in general appearance to *Falco anatum* of North America, and to *Falco peregrinus* of Europe and Asia, but differs from both in size, in the colors of the young, and in other characteristics. The bill is disproportionately weaker than in either of those birds. *Adult.* Frontal band of white very narrow; head, and neck above, and cheeks, clear black with a tinge of cinereous; other upper parts bluish cinereous, every feather having transverse strips of brownish black, lighter on the rump and other coverts of the tail. Throat and breast pale reddish white; other parts lighter, with circular spots and transverse bands of black, and with a tinge of cinereous on the flanks and abdomen. Tail above pale bluish cinereous, with transverse bars of brownish black, and narrowly tipped with white. Patch of black on the cheek very large, and scarcely separated from the same color of the head above and neck. *Younger.* Entire plumage above, dark brown; many feathers, especially on the rump, tipped and edged with rufous. Tail above brown, with a tinge of ashy, and barred with ferruginous on the inner webs. Under parts pale reddish ferruginous; paler on the throat; all the feathers with broad longitudinal stripes of black, and many of them with irregular transverse stripes of the same color, which predominates on the flanks and under coverts of the wings, which latter are marked with reddish-white bars and circular spots. Tibiæ, with transverse bars of brownish black. Total length, female, (of skin,) about 47 inches, wing 12 to 13, tail 6 to 6½ inches. Male smaller.

Beautiful specimens of this bird are in the present collection, and we have seen others, which appear to be identical, from California and New Mexico. They are uniformly smaller than *Falco anatum*, and with the bill comparatively weak. The young bird of the species now before us is of a deeper and different shade of reddish than in that just mentioned, but more resembles *Falco peregrinator* of India, and *Falco puniceus* of Africa. The cheeks in the present species are as strongly marked with black as in *Falco melanogenys* of Australia. It is of unusual occurrence in Chile, and probably only visits that country in the course of its winter migration from the north.

TINNUNCULUS SPARVERIUS, (Linn.)

Falco sparverius, LINN. Syst. Nat. I, 1766, 128.
Falco dominicensis, GM. Syst. Nat. I, 1788, 285.
Falco gracilis, cinnamominus and *isabellinus*, SW. Cab. Cy. Birds, Part III, 1838, 281.
Falco sparverius, (LINN.) GAY, Fauna Chilena, Aves, 227.
VULG. *Sparrow-Hawk. Cernícalo.*
FIGURES.—VIEILL. Ois. d'Am. Sept. I, Pl. xii, xiii.
" WILSON Am. Orn. II, Pl. xvi, Fig. 1.
" AUD. B. of Am. Pl. xlii, oct. ed. Pl. xxii.
" BUFFON, Pl. Enl. 465.

In specimens of this bird in the present collection, and in many other specimens from South America that have come under our notice, we have failed to find any characters distinguishing them from the common bird of the United States. It is of frequent occurrence in Chile, and has been observed in Patagonia. In the former country it is a constant resident.

P. S. Duval & C.° Steam lith press Phil.

FALCO NIGRICEPS CASSIN.
Male.

HYPOTRIORCHIS FEMORALIS, (Temm.)

Falco femoralis, Temm. Pl. col. I, livraison 58.
Harpagus bidentatus, (Gray,) Gay, Fauna Chilena, Aves, 230.
Vulg. *Alcon* or *Halcon.*
Figures.—Temm. Pl. col. I, Pl. cxxi, cccxliii.

A very handsome South American Hawk, recently added to the fauna of the United States by Dr. Hermann, who observed and obtained fine specimens in New Mexico.

This species is trained for the pursuit of the smaller gallinaceous birds, and is highly esteemed by the Chilean falconers. It is stated by Mr. Bridges (Proc. Zool. Soc., London, 1843, p. 109) to become docile and to follow its master in so short a period as fifteen days after its capture.

STRIX PERLATA, Licht.

Strix perlata, Licht. Verz. 1823, 59.
Gay, Fauna Chilena, Aves, 257.
Vulg. *South American Barn Owl. Lechuza.*

A species peculiar to South America, and much resembling *Strix pratincola* of North America and the European *Strix flammea.* The most readily observed distinctive character is the longer legs, and especially the *tarsi* of the present bird, (as indicated in the description of Prof. Lichtenstein,) in addition to which, it is much smaller than the North American species, and smaller also than *Strix flammea.*

This Owl is represented as of rather unusual occurrence in Chile, but inhabits sparingly decayed buildings in all parts of the country. It appears to be very similar in its habits to the common species of this genus.

BUBO CRASSIROSTRIS, (Vieill.)

Strix crassirostris, Vieill. Nouv. Dict. VII, 1817, 44.
Ulula crassirostris, (Vieill.) Gay, Fauna Chilena, Aves, 254.
Strix macrorhyncha, Temm. Pl. Col. II, about 1823.
Vulg. *South American Horned Owl. Tucuquer.*
Figure.—Temm. Pl. Col. II, Pl. lxii.

Of this large species excellent specimens of both sexes are in the collection of the Expedition. It has occasionally been confounded with the Great American Horned Owl of the United States, (*Bubo virginianus,*) but is clearly distinct, and may always be distinguished from that species by its much larger and more powerful bill.

This is one of the largest Owls of western South America, and is rather an uncommon bird near cities in Chile, though occasionally met with in the mountains.

OTUS BRACHYOTUS, (Forster.)

Strix brachyotus, Forst. Phil. Trans. London, LXII, 1772, 384.
Strix Georgica, Lath. Ind. Orn. Supp. I, 1801, 15.
Ulula otus, Gay, Fauna Chilena, Aves, 251.
Vulg. *Short-eared Owl. Nuco.*
Figures.—Wilson, Am. Orn. IV, Pl. xxxiii, Fig. 3.
" Aud. B, of Am. Pl. ccccx; oct. ed. I, Pl. 38.

Some of the finest specimens that we have ever seen of this kind are in the present collection. We regard them, however, as identical with the bird of North America. This species is represented to be rare in Chile.

ATHENE CUNICULARIA, (Molina.)

Strix cunicularia, Mol. Sagg. Stor. Nat. Chili, 1782.
Strix californica, Aud. B. of Am. Pl. ccccxii; (name on plate.)
Athene patagonica, Peale, Zool. Exp. Exp. Vincennes, Birds, 78, first edition 1848.
Noctua cunicularia, (Linn) Gay, Fauna Chilena Aves, 245.
Vulg. *Burrowing Owl. Pequen.*

This species, very similar to the Burrowing Owl of North America, is abundant on the *Pampas*, and, like that species, is found in large communities. It lives in holes in the ground, which, in some instances, it excavates for itself, but prefers appropriating those made by various small quadrupeds, and is one of the few Owls that habitually venture abroad by daylight.

This bird is larger than, and quite distinct from, the North American species, (*Athene hypugæa*,) though apparently very similar in its habits.

Lieutenant Gilliss remarks: "This is the most common of the Owl tribe in Chile, and a pair may often be encountered in daylight watching from a cactus or hedge an opportunity to strike one of the numerous field-rats, lizards, &c., which have their holes in the vicinity."

GLAUCIDIUM NANUM, (Vigors.)

Strix nana, Vig. Zool. Jour. III, 1827, 427.
Strix ferox, Vieill. Nouv. Dict. VII, 1817, 22.
Noctua pumila, Gay, Fauna Chilena, Aves, 244.
Vulg. *Dwarf Owl. Chuncho.*
Figure.—Gray's Gen. of Birds, I, Pl. xii.

One of the smallest of the birds of this family, and of frequent occurrence in Chile.

Order II. INCESSORES.

Tribe I. CONIROSTRES.

PSARACOLIUS CURAEUS, (Molin.

Plate XV. Adult male.

Sturnus curaeus, Molina, Sagg. Stor. Nat. Chili, 1782.
Sturnus aterrimus, Kittlitz, Mem. Acad. St. Petersburg, II, 1334, 467.
Leiestes niger, Swainson, Cab. Cy. Birds, Pt. III, 1838, 304.
Agelaius curaeus (Molina,) Gay, Fauna Chilena, Aves, 348.
Vulg. *Chilean Blackbird. Tordo.*

This bird, allied to the Grakles and Blackbirds of North America, is abundant in Chile and other countries of western South America, and, like its relatives of the north, congregates in large flocks at seasons when not occupied with the duties of incubation. It habitually frequents

W. Dresser Del

PSARACOLIUS CURAEUS, [MOLINA.]

P.S. Duval & co. steam lith. press Phil.

1 AGELAIUS THILIUS (MOLINA.)
Male.

2 STURNELLA MILITARIS (LINN.)
Male.

fields and open plains, running on the ground and attracting attention by its incessant chattering. Being readily domesticated, it is frequently met with in cages at the houses of the inhabitants.

"In captivity," says Lieutenant Gilliss, "this bird is taught to pronounce words quite distinctly. It is one of the farmer's pests, and many are destroyed; but though the flesh is good, it is not esteemed by natives."

AGELAIUS THILIUS, (Molina.)

PLATE XVI, Fig. 1.

Turdus thilius, MOLINA, Sagg. Stor. Nat. Chili, 1782.
Xanthornus cayennensis, (GRAY,) GAY, Fauna Chilena, Aves, 346.
VULG. *Yellow-winged Blackbird. Trille.*

Another species related to the northern Blackbirds, especially the Red-wing and others of the same group. It is, however, strongly characterized and easily distinguished by its yellow shoulders, agreeably contrasting with the deep black of its other plumage.

This bird inhabits marshes and other localities in the vicinity of water, and is frequently met with. "This is the bird," observes Lieut. Gilliss, "from which it has been said came the name of the country, the notes it utters greatly resembling *Chil-li, Chil-li.* It is very abundant about ploughed fields in the spring of the year."

STURNELLA MILITARIS, (Linn.)

PLATE XVI, Fig. 2. Adult male.

Sturnus militaris, LINN. Mantiss, 1770, 527.
Leistes Americanus, VIG. Gay, Fauna Chilena, Aves, 350.
VULG. *Chilian Lark. Loica.*

This handsome bird is intimately related in general form to the meadow lark of the United States, (*Sturnella ludoviciana*,) but in colors is entirely different. Its habits are, too, very similar, being found on the plains, and building its nest on the ground.

Several distinct but closely allied species are now known to have been indiscriminately referred to as *Sturnella militaris* by naturalists and travellers. The present species, however, appears to be that really entitled to this designation. It is abundant in Chile.

PHRYGILUS FRUTICETI, (Kittlitz.)

Fringilla fruticeti, KITTLITZ ,Kupf. der Vog. 1833, 18.
Emberiza luctuosa, EYDOUX and GERV. Mag. de Zool. 1836, 24.
Chlorospiza fruticeti, (KITTL.) GAY, Fauna Chilena, Aves, 357.
FIGURES.—KITTLITZ, Kupf. Pl. xxiii, Fig. 1.
" GUÉRIN Mag. de Zool. 1836, Pl. lxxi.

This little Finch frequents fields and shrubbery, but is not a common species. It extends its range over the whole of western South America, but having been seldom seen by the members of the Expedition, may be regarded as rare in Chile.

PHRYGILUS UNICOLOR, (D'Orbigny.)

Emberiza unicolor, D'Orbigny, Guérin's Mag. 1837, 79.
Figure.—Jardine's Contributions to Ornithology, 1849, Pl. xxii.

This bird, like the preceding species, was noticed both in the mountains and plains, but not in abundance.

PHRYGILUS DIUCA, (Molina.)

Fringilla diuca, Mol. Hist. Nat. del Chile; Gay's Fauna Chilena I, 359.
Pipilo cinerea, Peale, Zool. U. S. Ex. Exp. Birds, 1848, 123.
Vulg. *Diuca.*
Figures.—Kittl. Mem. Acad. St. Petersb. I, Pl. xi.
" Voy. Favorite Zool. Pl. xvii.
" Guérin's Mag. 1836, Pl. ix.

One of the most abundant and long known birds of western South America. Lieutenant Gilliss's notes on this species are as follows: "This is one of the commonest and most widely-spread birds in Chile. At certain seasons it is found in quite large numbers near the threshing-fields, or where cattle have stood near a wayside tavern. It is also quite domestic, and will be found in any street of all the cities. It builds in bushes, returning year after year to the same nest, and is certainly one of the earliest risers, for I have often heard its sprightly notes about Santa Lucia before the first streaks of dawn were fairly peering over the Andes."

PHRYGILUS GAYI, (Eydoux and Gervais.)

Fringilla Gayi, Eyd. and Gerv. Mag. de Zool. 1834, (not paged.)
Chlorospiza Gayi, (Eyd. and Gerv.) Gay, Fauna Chilena, Aves, 355.
Vulg. *Gay's Finch.*
Figures.—Guérin's Mag. de Zool. 1834, Pl. xxiii.
" Voy. Favorite, Ois. Pl. xxiii.

A beautiful little Finch, abundant in the vicinity of the cities and about farm-houses, but retiring to the mountains in the season of incubation. It migrates southward to Patagonia.

ZONOTRICHIA MATUTINA, (Lichtenstein.)

Fringilla matutina, Licht. Verz. 1823, 25.
Tanagra ruficollis, Spix Av. Bras. II, 1825, 39.
Fringilla Mortonii, Aud. Orn. Biog. V, 1839, 312.
Fringilla matutina, Licht. Gay, Fauna Chilena, Aves, 360.
Vulg. *Collared Sparrow. Chincol.*
Figures.—Kittlitz Kupf. Pl. xxiii, Fig. 3.
" Dubois Orn. Gal. Pl. xlii.
" Spix Av. Bras. Pl. liii, Fig. 3.
" Aud. B. of Am. oct. ed. III, Pl. clxl.

This Sparrow is one of the most abundant of the birds of Chile, and is found diffused also over almost the whole of South America. In Chile it inhabits the cultivated districts, and is found also in the mountains at an elevation of several thousand feet.

Natural Size

W. Prasen del.

T. Sinclair's lith. Phila.

CHRYSOMITRIS MARGINALIS, [BONAPARTE.]

male and female

W. Breser Del. J. Pinchart Lith. Phil.

1. CALLISTE CYANICOLLIS. [D'ORBIGNY.]

Adult Male

2. CALLISTE LARVATA. [DU BUS.]

Adult Male

This bird, though apparently belonging to this genus, does not strictly accord with the characters of that group embracing the North American species. It is well figured in all the plates cited above, especially in those of Spix and Audubon. The last author erroneously gave it as a North American bird, from the fact that specimens were contained in the collection sent home by the late Dr. Townsend, which were, however, obtained in the vicinity of the city of Valparaiso. It is found in Peru, Brazil, and Patagonia, and exhibits the harmless and unsuspicious habits characteristic of many of the birds of this family.

CRITHAGRA LUTEIVENTRIS, (Meyen.)

Fringilla luteiventris, MEYEN Nova Acta XVI, 1834, 87.
FIGURE.—Nova Acta Acad. Breslau XVI, Pl. xii, Fig. 3.

Several specimens of this bird are labelled as having been obtained in the Andes.

CHRYSOMITRIS ATRATUS, (D'Orb. and Lafres.)

Carduelis atratus, D'ORB. and LAFR. Guérin's Mag. 1837, 83.
FIGURE.—D'ORBIGNY Voy. Am. Mer. Ois. Pl. xlviii, Fig. 2.

Specimens are labelled as having been obtained in the interior. This little bird is stated to appear occasionally in flocks, though it probably visits Chile only in the season of migration.

CHRYSOMITRIS MARGINALIS, Bonap.

PLATE XVII. Male and female.

Chrysomitris marginalis, BONAP. Cons. Av. 1850, 517.

Of this singular new Goldfinch two specimens only are in the collection, which are, however, male and female. It bears a great resemblance to the European *Chrysomitris spinus*, but is larger, and the bill is much stronger; in fact, the latter character is sufficient to distinguish it from any other species of this genus with which we are acquainted.

Male, with the head above and large space on the throat, black. Back, yellowish green, with obscure longitudinal stripes of brownish; rump and upper tail coverts yellow; quills brownish black, at their bases yellow, forming a conspicuous mark on the wing; tail brownish black; under parts (except the throat) pale ashy yellow; bill short, thick. Female very similar to the male, but with no black on the head and throat, and with the yellow markings on the wings less conspicuous. In all its colors this bird almost precisely resembles the European species above mentioned. We have no account of its habits or history.

CALLISTE CYANICOLLIS, (D'Orbigny.)

PLATE XVIII, Fig. 1. Adult male.

Aglaia cyanicollis, (D'ORB.) GUERIN's Mag. de Zool. 1837, 33.
Aglaia cacruleocephala, SWAINS. Cab. Cy. Birds, Pt. III, 1838, 356.
VULG. *Blue-headed Tanager.*

Of this species, hitherto known as a bird of Peru, one specimen only is in the collection, without label. Though it is not in our power to present any facts in the history of this beau-

tiful species, we have availed ourselves of the opportunity to figure it in the plates accompanying this catalogue. For the convenience of comparison we have figured also—

PLATE XVIII, Fig. 2. Adult male.

Calliste larvata, DU BUS. Esquisses Ornithogiques, Pt. II, 1846.
Aglaia Fanny, LAFRES. Rev. Zool. 1847, 72.

This bird is a native of Central America and New Grenada. It is closely related to the species immediately preceding.

CALLISTE GYROLOIDES, (Lafresnaye.)

PLATE XIX, Fig. 1.

Aglaia gyroloides, FAFRES. Rev. Zool. 1847, 277.
Calliste cyanoventris, GRAY, Genera II, 366.
Aglaia peruviana, SWAINS. Cab. Cy. Birds, Pt. III, 356.
VULG. *Peruvian Tanager.*

This handsome Tanager has also been known as a bird of Peru. It belongs to a group containing several very nearly allied species which inhabit different parts of South America. The two last names given above have priority of date over the one that we adopt, but both were previously used for species which appear to belong to this group. We have inserted in the present—

PLATE XIX, Fig. 2.

Calliste Desmarestii, GRAY, Gen. II, 1804, 366.
Aglaia viridissima, LAFRES. Rev. Zool. 1847, 277.

This species inhabits the more southern of the West Indies, and probably the northeastern part of South America. Another species nearly related to the present two birds is found in Brazil. It is *Calliste gyrola.*, (LINN.,) and is very similar in general coloring to the birds now before us, but may readily be distinguished by its having the shoulders (or lesser-wing coverts) golden yellow, and its under parts tinged only with blue.

EUPHONIA RUFIVENTRIS, (Vieill.)

PLATE XX, Fig. 1. Adult male.

Tanaga rufiventris, VIEILL. Nouv. Dict. PXXII, 426.
Euphonia bicolor, (STRICKLAND,) JARDINE's Cont. to Orn. 1850, 48.

Of this handsome little bird, previously known as an inhabitant of Peru, one specimen only is in the collection. It is clearly distinct, though nearly related to others of this group.

In the present we have taken the liberty of inserting, as further illustrating this family of birds—

PLATE XX, Fig. 2. Adult male.

Chlorophonia occipitalis, (DU BUS.)
Euphonia occipitalis, DU BUS, Esqu. Orn. Pt. III, 1847.

This is one of the most beautiful of the family of Tanagers, and has escaped the notice of naturalists until the recent date above given. It is a native of Mexico, and the male has not before been figured, though the female is given by Du Bus in the work above cited. (Pl. xiv.)

W. [illegible]ner Del. Sinclair & Son Phot.

1. CALLISTE GYROLOIDES, [LAFRES.]

Adult male

2. CALLISTE DESMARESTII, [GRAY.]

Adult male

W. Dreser del.

1. EUPHUNIA RUFIVENTRIS, [VIEILL.]
Adult male

2. CHLOROPHONIA OCCIPITALIS, [DU BUS.
Adult male

PHYTOTOMA RARA, Molina.

Phytotoma rara, Molina, Sagg. Stor. Nat. Chili, 1782.
Phytotoma silens, Kittlitz, Mem. Acad. St. Petersburg I, 1831, 175,
Phytotoma Bloxhami, (Children,) Griffith's ed. Cuv. Reg. An. II, 1829, 319.
Phytotoma rara, (Mol.) Gay, Fauna Chilena, Aves, 363.
Vulg. *Rara.*
Figures.—Jard. and Selb. Ill. Orn. I, Pl. iv.
" Guerin, Mag. de Zool. 1844, Pl. 5.
" Kittlitz, Mem. Acad. St. Petersburg, Pl. i.

This bird is of frequent occurrence in Chile, and is one of the most remarkable of the birds of that country. It is provided with a short, strong bill, with the edges of both mandibles serrated, and well adapted to the destruction of tender plants or the buds of fruit trees, on which it subsists, and does much injury to orchards and gardens.

This may be regarded as the only well known species of this singular group of birds, though several others have been described by naturalists as inhabiting various parts of South America.

Excellent specimens are in the collection of the expedition, mostly obtained in the vicinity of Santiago, though this bird is found throughout the country from Coquimbo to Chilóe.

Tribe II. DENIROSTRES.

AGRIORNIS LIVIDUS, (Kittlitz.)

Thamnophilus lividus, Kittlitz, Mem. Acad. St. Petersburg, II, 1834, 465.
Tyrannus gutturalis, Eyd. and Gerv. Mag. de Zool. 1836, 6.
Dasycephala livida, (Kittl.) Gay, Fauna Chilena, Aves, 327.
Vulg. *Mero.*
Figures.—Mem. Acad. St. Petersburg, II, Pl. i.
" Guerin's Mag. de Zool. 1836, Pl. 63.

This species is of frequent occurrence throughout Chile.

MIMUS THENCA, (Molina.)

Turdus thenca, Mol. Sagg. Stor. Nat. Chili, 1782.
Gay, Fauna Chilena, Aves, 333.
Vulg. *Chile Mocking Bird. Thenca*, or *Trenca.*

A species nearly allied to the Mocking Bird of North America, (*Mimus polyglottus*,) and, like it, possesses remarkable powers of song. It is a common bird of Chile, and a universal favorite, frequenting the cultivated parts of the country.

Of the birds of this group, several other species inhabit South America, all of which are more or less intimately related to our famed northern songster, and possessing considerable reputation themselves as performers in the same line. The present species is regarded as the best.

MERULA FALKLANDICA, (Quoy and Gaimard.)

Turdus falklandicus, Quoy and Gaim. Voy. Uranie Zool. I, 1824, 104.
Turdus magellanicus, King, Proc. Zool. Soc. London, 1830, 14.
Turdus falklandicus, (Quoy and Gaim.) Gay, Fauna Chilena, Aves, 331.

This bird is abundant throughout Chile, inhabiting cultivated grounds, and migrating southward. It bears a strong general similarity in colors to the Robin of North America, (*Merula migratoria*.)

Several fine specimens in the collection of the Expedition differ from each other in the shades of color, though apparently presenting no other different characteristics. There are, however, several closely allied species of this genus known to inhabit various countries of South America.

MERULA FUSCATER, (D'Orb. et Lafr.)

Turdus fuscater, D'Orb. et Lafr. Mag. Zool. 1836, 16.
(D'Orb. and Lafr.) Gay, Fauna Chilena, Aves, 331.

Vulg. *Zorzal.*

Figure.—D'Orb. Voy. Am. Mer. Ois. Pl. ix.

Much resembling the preceding in general character and appearance.

Of this bird Lieut. Gilliss observes: "The *Zorzal* is extremely common, and one of the greatest pests of the vineyard when the fruit is maturing. It is exceedingly sluggish in its habits, and will suffer boys to drive it between two gradually inclining hedges, until the space is so narrow that it rises with difficulty, if at all, and is knocked on the head, to find its way to the tables of the better classes, by whom its flesh is greatly esteemed. It is also occasionally captured and retained in cages, but I never heard one sing. Albinoes of this species are not uncommon."

PTEROPTOCHUS MEGAPODIUS, Kittlitz.

Pteroptochus megapodius, Kittlitz Mem. Acad. St. Petersburg I, 1830, 182.
Megalonyx rufus, Less. Cent. Zool. 1830, 200.
Vulg. *Great-footed Ground Thrush. Turco.*
Figures.—Mem. Acad. St. Petersburg I, Pl. iv.
" Less. Cent. Zool. Pl. lxvi.

This is one of the most singular of the birds of Chile. It is about the size of the robin of North America, of plain colors—brown above and yellowish white below—with a short tail, and the legs and feet so disproportionately large as almost to appear deformed. Frequenting the ground, and moving with a gait more of the character of hopping than walking, and with its tail habitually carried erect, it attracts attention by its grotesque appearance. "On first seeing it," says an excellent naturalist and very agreeable writer who visited Chile, (Mr. Charles Darwin, M. A. F. R. S.) "one is tempted to exclaim, 'a vilely-stuffed specimen has escaped from some museum, and has come to life again!'"

This species subsists on insects, and is frequently met with throughout the country.

PTEROPTOCHUS ALBICOLLIS, Kittlitz.

Pteroptochus albicollis, Kittlitz Mem. Acad. St. Petersburg I, 1830, 180.
Pteroptochus megapodius, (Kittl.) Gay, Fauna Chilena, Aves, 302.
Megalonyx medius, Lesson Ill. Zool. 1831, (not paged.)
Vulg. *White-throated Ground Thrush. Tapaculo.*
Figures.—Mem. Acad. St. Petersburg I, Pl. iii.
" D'Orbigny Voy. Am. Mer. Ois. Pl. viii, Fig. 2.
" Less. Ill. Zool. Pl. lx.
" Kittl. Kupf. Pl. xvi, Fig. 2.

This bird, though smaller than the preceding, is, like it, remarkable on account of its appearance and odd movements. It is an abundant species, and lives in waste lands, always frequenting the ground. Both the species now mentioned have loud and very peculiar notes; another of this group, related to the present species, has, from its voice, obtained the name of "the barking bird." The name of the bird now before us as given above, and by which it appears to be known in the districts it inhabits, *Tapaculo*, it would not perhaps befit us to translate literally into English on the present occasion. It seems to have been derived, however, from its habit of carrying its tail erect, probably to the disadvantage, as the artists say, of the posterior view. Lieutenant Gilliss says, however: "This bird may be heard on all the hills of the interior in the central provinces uttering its *tap-pa-cül, tap-pa-cül*, which is most probably the origin of its common name."

LICHENOPS ERYTHROPTERUS, Gould.

Lichenops erythropterus, Gould, Voy. Beagle, Birds, 1841, 52.
Lichenops perspicillatus, (Gray,) Gay, Fauna Chilena, Aves, 337.
Motacilla perspicillata, Gmelin, Syst. Nat. I, 1788, 969. ?
Vulg. *Colegial.*
Figure.—Voy. Beagle, Birds, Pl. ix.

A handsome little bird, frequenting the ground, and usually met with in the vicinity of streams of water and other damp localities.

This species has been regarded by late ornithologists as the female or young of *Lichenops perspicillatus*, though it appears to us to present peculiar characters. All the specimens in the collection of the Expedition are in the plumage described by Mr. Gould as above.

TÆNIOPTERA PYROPE, (Kittlitz.)

Muscicapa pyrope, Kittlitz, Mem. Acad. St. Peters. I, 1830, 191.
Tænioptera pyrope, (Kittl.) Gay, Fauna Chilena, Aves, 335.
Vulg. *Garnet-eyed Fly-catcher. Diucon.*
Figure.—Mem. Acad. St. Peters. I, Pl. x.

This plain but interesting Fly-catcher is abundant in Chile and other countries of the western coast of South America. It is related, not remotely, to various species of the northern tyrant fly-catchers.

This bird is particularly remarkable on account of its bright red irides, from which has been derived its specific name.

PTYONURA MENTALIS, (Lafresnaye.)

Muscisaxicola mentalis, Lafres. Guérin's Mag. 1837, 66.
Figure.—D'Orbigny, Voy. Am. Mer. Ois. Pl. xli, Fig. 1.

A little Fly-catcher much resembling in color and general characters the common pewee Fly-catcher of North America, (*Tyrannula fusca*), but, unlike it, lives habitually in the low bushes and on the ground. It inhabits the most barren districts in the mountains, and at some seasons ranges over the plains in small flocks. It is partial to the vicinity of streams of water and of marshy places.

PTYONURA RUFIVERTEX, (Lafresnaye.)

Muscisaxicola rufivertex, Laf. Guérin's Mag. 1837, 66.
Figure.—D'Orb. Voy. Am. Mer. Ois. Pl. xl, Fig. 2.

Of this Fly-catcher fine specimens are in the collection of the Expedition. It inhabits the mountains.

CYANOTIS OMNICOLOR, (Vieill.)

Regulus omnicolor, Vieill. Gal. des Ois. I, 1825, 271; Gay, Fauna Chilena, Aves, 319.
Sylvia rubigastra, Vieill. Nouv. Dict. XI, 1807, 277.
Regulus Byroncusis, Gray, Giff. Cuv. VII, 1829, 42.
Vulg. *Siete-color.*
Figures.—Gay's Chile, Birds, Pl. iii.
" Vieill. Gal. I, Pl. clxvi.

One of the most beautiful of the birds of western South America, though not abundant in Chile. It is allied to the crested wrens of North America and Europe, and appears to resemble them in habits, living in the forests and subsisting on small insects.

Lieutenant Gilliss observes of this species: "This is undoubtedly the most brilliant bird of Chile, but is not very abundant. It lives in the vicinity of marshy ground where the *typha angustifolia* grows, on one of the stalks of which its nest is usually constructed. The nest is correctly represented in Gay's Fauna Chilena."

Tribe III.—FISSIROSTRES.

STENOPSIS PARVULUS, (Gould.)

Caprimulgus parvulus, Gould, Voy. Beagle, Birds, 1841, 37.
Caprimulgus bifasciatus, (Gould) Gay, Fauna Chilena, Aves, 261.
Vulg. *Gallina ciega.*

This little Night-Hawk appears to be frequent in open lands near the foot of the mountains. It is a very distinct and well-marked species, and one of the smallest of the *Caprimulgidæ* which are known to inhabit America.

Tribe IV.—TENUIROSTRES.

TROCHILUS GIGAS, Vieill.

Trochilus gigas, Vieill. Gal. I, 1825, 296.
Gay, Fauna Chilena, Aves, 273.
Ornismya tristis, Less. Hist. Nat. des Ois. Mouches, 1829, 12.
Ornismya gigantea, D'Orb. and Lefr. Guérin's Mag. 1838, 26.
Vulg. *Giant Humming-Bird. Picaflor grande.*
Figures.—Vieill. Gal. des Ois. I, Pl. 180.
" Less. Ois. Mouches, Pl. iii.

This Humming-Bird, the largest yet discovered of its family, is one of the most abundant of the species of these birds found in Chile.

TROCHILUS GALERITUS, Molina.

Trochilus galeritus, Molina, Sagg. Stor. Nat. Chili, 1782.
Mellisuga Kingii, Vigors. Zool. Jour. III, 1827, 432.
Orthorhynchus sephanoides, Lesson, Voy. Coquille Ois. I, 1826, 681.
Trochilus sephanoides, (Less.) Gay, Fauna Chilena, Aves, 275.
Vulg. *Fire-crowned Humming-Bird. Picaflor. Piñuda.*
Figures.—Gould, Mon. Troch. Pt. III, Pl. i.
" Voy. Coquille Ois. Pl. xxxi, Fig. 2.

This beautiful species of Humming-Bird, remarkable for its red crest, is found in abundance in Chile, and ranges over a great extent of the other countries of the western coast of South America.

TROCHILUS LEUCOPLEURUS, (Gould.)

Oreotrochilus leucopleurus, Gould, Proc. Zool. Soc. Soc., London, 1847, 10.
Gay, Fauna Chilena, Aves, 277.
Vulg. *White-sided Mountain Humming-Bird.*
Figure.—Gould. Mon. Troch. Pt. I, Pl. iii.

Several specimens of this beautiful and curious Humming-Bird are in the collection of the Expedition, and were all obtained in the Andes at an elevation of several thousand feet. It appears to be exclusively an inhabitant of the higher valleys and approaches to near the line of perpetual snow.

CINCLODES VULGARIS, (D'Orb. and Lafr.)

Uppucerthia vulgaris, D'Orb. and Lafr. Guérin's Mag. 1838, 22.
Gay, Fauna Chilena, Aves, 282.
Vulg. *Churrete.*
Figures.—D'Orb. Voy. d'Am. Mer. Ois. Pl. lvii, Fig. 1.

A species found sparingly in Chile, but more abundant in other parts of South America. It is one of a curious group of birds, reminding us of the wrens, though of greatly increased dimensions.

The present bird is found along streams of water, running on the ground and subsisting on insects.

CINCLODES NIGROFUMOSUS, (D'Orb. and Lafr.)

Uppucerthia nigrofumosa, D'Orb. and Lafr. Guérin's Mag. 1838, 23.
Gay, Fauna Chilena, Aves, 283.
Opetiorhynchus lanceolatus, Gould, Voy. Beagle, Birds, 1841, 68,
Vulg. *Molinero.*
Figures.—Gould, Voy. Beagle, Birds, Pl. xx.
" D'Orb. Voy. Am. Mer. Pl. lvii, Fig. 2.

This bird lives almost exclusively on the shores of the sea, though occasionally met with on the margins of rivers and the smaller streams of water in the interior. It runs on the ground with facility, and is abundant on the coast of Chile.

UPPUCERTHIA DUMETORIA, Geoffr.

Uppucerthia dumetoria, Geoffroy, Nouv. Ann. du Mus. I, 1832, 394.
Gay, Fauna Chilena, Aves, 284.
Figure.—Voy. Beagle, Birds, Pl. xix.

Another of the birds of the same general habits as the two preceding. This fine species inhabits all parts of the country, but is most frequently seen in the plains, and frequently in the most barren districts. It is, however, occasionally met with in the Andes, as indicated by labels attached to specimens in the present collection. It is of common occurrence in Chile, and in other countries of western South America.

ERICORNIS MELANURA, Gray.

Plate XXI, Fig. 1. Adult male.

Ericornis melanura, G. R. Gray, Gen. Birds, I, 1847, 133.

Wings short, fourth quill slightly longest; tail rather long, rounded; bill very straight, slender; tarsi and toes strong. Head above and back pale brown, tinged with cinereous; rump and upper coverts of the tail bright rufous; quills dark brown, with the basal half of the shorter primaries and of the secondaries rufous. Throat and breast silky white; abdomen ashy; ventral region and under coverts of the tail rufous, darker on the latter. Bill dark, under mandible white at base; legs dark. Total length (of skin) about 7 inches, wing $3\frac{1}{4}$, tail $3\frac{1}{2}$.

Several specimens of this bird are in the collection of the Expedition, all of which agree very nearly in markings, and uniformly present the black tail, which distinguishes this species from *E. phœnicura*, (Gould.)

This bird habitually frequents the ground, and subsists on insects.

SYNALLAXIS DORSO-MACULATA, D'Orb and Laf.

Synallaxis dorso-maculata, (D'Orb and Laf.) Guerin's Mag. 1837, 21.
Sylvia melanops. (Vieill.) Gay, Fauna Chilena, Aves, 293.
Figures.—D'Orb. Voy. Am. Mer. Ois. Pl. xiv, Figs. 1 and 2.

This little bird is labelled as having been obtained in the interior. It inhabits the vicinity of water-courses, but is not abundant.

SCYTALOPUS FUSCUS, Gould.

Plate XXI, Fig. 2.

Scytalopus fuscus, Gould, Proc. Zool. Soc. London, 1836, 89.
Scytalopus obscurus, (Gould) Gay, Fauna Chilena, Aves, 308.
Vulg. *Chircan Negro.*

A single specimen only is in the collection of the Expedition. It is labelled as being a male bird, and the entire plumage is uniform dark slate color. Señor Salinas informed Lieut. Gilliss that this bird had wholly escaped his attention previously, perhaps because of its frequenting marshy ground, as much as from its obscure color.

It was obtained in the vicinity of Santiago.

Natural Size

W. Dreser del.

1. ERICORNIS MELANURA, [GRAY.]

Adult

2. SCYTALOPUS FUSCUS, [GOULD.]

Adult

PSITTACUS OCHROCEPHALUS. GMELIN

Tribe V. SCANSORES.

CONURUS CYANOLYSIOS, (Molina.)

Psittacus cyanolysios, Mol. Sagg. Stor. Nat. Chili, 1782.
Gay, Fauna Chilena, Aves, 367.
Psittacus patagonus, Vieill. Nouv. Dict. XXV, 1817, 367.
Vulg. *Patagonian Parrot. Loro.*
Figures.—Lear's Parrots, Pl. x.
" Voy. Coquille Ois. Pl. xxxv.

Of this interesting species, Lieut. Gilliss remarks: "Among the most numerous of all birds in the central provinces of Chile, congregating in flocks of hundreds to feed in the wheat fields in December, and on the seeds of the *cardo* (Cynara cardunculus,) when mature, during the month of April. Its nest is formed in holes along the river banks, from which flocks issue screaming most discordantly. In earthquakes they quit their nests in great terror, flying round and round, uttering their shrillest notes. The young birds are considered delicacies, and may always be found in the markets during the breeding season."

Several fine specimens of this bird are in the collection of the Expedition. This species shows a remarkable affinity to the Ground Parrots of Australia.

PSITTACARA LEPTORHYNCHA, King.

Psittacara leptorhyncha, King, Proc. Zool. Soc. London, 1830, 14.
Psittacus rectirostris, Meyen, Nova Acta. XVI, 1834, 95.
Leptorhynchus ruficaudus, Swainson, Cab. Cy. Birds, II, 1837, 300.
Enicognathus leptorhynchus (King,) Gay, Fauna Chilena, Aves, 370.
Psittacus cheroyeus, Molina.
Vulg. *Choroy.*
Figures.—Lear's Parrots, Pl. xi.
" Nova Acta, Breslau, XVI, Pl. xv.

Two specimens in the collection are labelled as having been obtained in the interior of Chile. It is remarkable for its pointed and attenuated upper mandible, and very probably presents habits differing from those usually possessed by birds of this family. We much regret that no notes relating to this species are in our possession.

PSITTACARA SMARAGDINA, (Gm.)

Psittacus smaragdinus, Gmelin, Syst. Nat. I, 1788, 322.
Figure.—Buff, Pl. Enl. lxxxv.

A single specimen of this species is labelled as having been obtained in Chile.

PSITTACUS OCHROCEPHALUS, Gmelin.

Plate XXII. Adult male.

Psittacus ochrocephalus, Gmelin, Syst. Nat. I, 1788, 339.
Vulg. *Choroy.*

Total length (of skin) about 15 inches, wing $8\frac{1}{2}$, tail $5\frac{1}{2}$ inches.

One specimen only is in the collection, and is labelled as having been obtained in the interior of the country. This appears to be the bird entitled to the name above cited, though it has been applied to other species of the same group nearly allied and somewhat difficult to distinguish.

COLAPTES PITIUS, (Molina.)

Picus pitius, Mol. Sagg. Stor. Nat. Chile, 1782.
Picus chilensis, Lesson, Voy. Coquille Ois. 1826, 241.
Colaptes pitiguus, (Mol.) Gay, Fauna Chilena, Aves, 373.
Vulg. *Carpintero, Pitigüe.*
Figure.—Voy. Coquille Ois. Pl. xxxii.

This fine species, allied to the northern Golden Shafted Woodpecker, or Flicker, (*Colaptes auratus,*) is common throughout the southern part of Chile, and is met with sparingly in the north. It is an inhabitant of the plains, and habitually frequents the ground, subsisting on small insects.

PICUS LIGNARIUS, Molina.

Picus lignarius, Molina, Sagg. Stor. Nat. Chili, 1782.
Picus melanocephalus, King, Proc. Zool. Soc. London, 1830, 14.
Gay, Fauna Chilena, Aves, 372.
Picus puncticeps, D'Orbigny, Voy. Am. Mer. Ois. 1835, 379, Pl. lxiv, Fig. 1.

Inhabits wooded and mountainous districts, and is extensively diffused throughout western South America.

Order III. RASORES.

COLUMBA ARAUCANA, Lesson.

Columba araucana, Lesson Voy. Coquille Zool. I, 1826, 706.
Gay, Fauna Chilena, Aves, 376.
Columba denisea, Temm. Pl. col. I, (not paged.)
Columba Fitzroyi, King Proc. Zool. Soc. London, 1830, 15.
Vulg. *Torcassa.*
Figures.—Voy. Coquille, Atlas, Birds, Pl. xl.
" Temm. Pl. col. 502.

This very handsome bird, one of the largest of the Pigeons of South America, inhabits nearly the whole of Chile, rearing its young in the forests and mountainous districts, and at other seasons congregating in flocks. It extends its range southwardly to Cape Horn and Tierra del Fuego.

Lieutenant Gilliss observes: "This is a much finer bird for the table than the pigeon of North America, being larger and more juicy. Like it, the species congregates in flocks during the latter part of autumn and winter, and large numbers are brought to the market in Santiago from the woody hills in the vicinity. At times it is so abundant that four birds may be bought for a rial; but during the autumn and winter of 1852 (May to September) there were scarcely any seen. It migrates southward."

ZENAIDA AURITA, (Temminck.)

Columba aurita, Temm. Pig. et Gall. II, 1811, 60.
Peristera auriculata, Gay, Fauna Chilena, Aves, 1847, 381.
Vulg. *Tortola, Tortolita.*
Figures.—Temm. Pig. II, Pl. xxv.
" Gay, Chile, Aves, Pl. vi.

Several specimens of this bird are in the collection, and it is represented to be the most abundant of the doves of Chile. Although our specimens appear to be the species figured by Temminck as above, they bear a strong resemblance to that described and figured as a distinct bird by Gay. We suspect that they are identical.

The present bird is of common occurrence throughout the country, and is killed for the table. At some seasons it assembles in large flocks, and in its migrations extends its range southwardly.

COLUMBINA STREPITANS, (Spix.)

Columba strepitans, Spix Av. Bras. II, 1825, 57, Pl. lxxv, Fig. 1.
Vulg. *Tortolita Cordillerana.*

The specimens of this pretty little species are labelled as having been obtained in the mountains. It is usually found on the ground, and appears to be partial to the vicinity of streams of water.

THINOCORUS ORBIGNYIANUS, Less.

Thinocorus Obignyianus, Less. Cent. Zool. 1830, 137.
Gay, Fauna Chilena, Aves, 387.
Vulg. *Agachadera. Petaquito.*
Figure.—Lesson Cent. Zool. Pl. xlix, 1.

This is a bird of a singular group, the species of which appear to be peculiar to the countries of western South America.

The present species inhabits the plains, and is found also in the valleys of the Andes. Our specimens bear labels indicating the latter locality. It frequents the ground, on which it runs with great swiftness, and occasionally congregates into flocks.

THINOCORUS RUMICIVORUS, Eschsch.

Thinocorus rumicivorus, Eschscholtz, Zool. Atlas, 1829, 2.
Gay, Fauna Chilena, Aves, 387.
Thinocorus Eschscholtzii, Less. Cent. Zool. 1830, 140.
Ocypetes Torquatus, Wagler.
Vulg. *Agadaehera de la Cordillera. Perdizita.*
Figures.—Eschsch. Zool. Atl. Pl. ii.
" Less. Cent. Zool. Pl. 1.

A larger species than the preceding, and is an inhabitant of the higher mountain valleys, but not exclusively, being found also on the plains.

In addition to the two species here given, and which are well known as birds of Chile, we

have seen a third, *T. Swainsonii*, Lesson, also from that country. All these very considerably resemble each other in colors and other characters, but differ so materially in size as to leave no doubt of their specific distinctness. *T. rumicivorus* is the largest, *T. Swainsonii* the smallest.

ATTAGIS GAYII, Less.

Attagis Gayii, Lesson Cent. Zool. 1830, 135.
Gay, Fauna Chilena, Aves, 384.
Vulg. *Perdiz Cordillerana.*
Figures.—Less. Cent. Zool. Pl. xlvii.
" Gay's Fauna Chilena Orn. Pl. (not numbered.)

Several fine specimens of this remarkable bird were obtained in the Andes, which it inhabits at a considerable elevation. It lives entirely on the ground, and is generally met with in small parties or coveys.

This bird appears to us to present affinities to the grouse, though exhibiting singularly well-marked generic characters. It is one of the most remarkable of the birds of Chile.

NOTHURA PERDICARIA, (Kittlitz.)

Crypturus perdicarius, Kittl. Mem. Acad. St. Peters. I, 1830, 192.
Vulg. *Perdiz.*
Figure.—Mem. Acad. St. Peters. I, Pl. xii.

This bird is frequently met with throughout nearly the whole of Chile. It is usually seen in the cultivated districts, but appears also, from specimens now before us, to be an inhabitant of the mountains. It lives entirely on the ground, and is shot for the table.

In the collection of the Expedition several specimens are considerably smaller than others, though otherwise so very similar that we can determine no specific differences. The smaller specimens are, moreover, labelled as females, which at present we are disposed to regard them. Lieutenant Gilliss's notes on this species are as follows: "This bird never congregates in flocks or coveys, but is only seen in pairs, and when startled utters a shrill noise until it alights, after a few minutes' flight. The adult bird is one-fourth larger than the partridge of the United States, and it attains maturity in one year; its flesh is quite as white, and more juicy. It lays twelve to fourteen eggs, of a beautiful and uniform sombre violet color, highly polished."

Order IV. GRALLATORES.

ARDEA COCOI, Linn.

Ardea cocoi, Linn. Syst. Nat. I, 1766, 237.
Gay, Fauna Chilena, Aves, 409.
Ardea cœrulescens, Vieill. Nouv. Dict. XIV. 1817, 413.
Ardea maguari, Spix, Av. Bras. II, 1824, 71.
Vulg. *Patagonian Heron. Cuca.*
Figure.—Spix, Av. Bras. II, Pl. xc.

A single specimen only of this large species is in the collection of the Expedition, and is stated to have been obtained in the interior of the country.

Lieut. Gilliss remarks: "This very rare bird in central Chile was presented by Señor Salinas,

who would not depreciate its merit by assigning a price to it. The only other specimen which had been obtained by the same gentleman in three years had also been given away—the latter to an eminent clergyman in Santiago."

EGRETTA GALATEA, (Molina.)

Ardea galatea, Molina, Sagg. Stor. Nat. Chili, 1782; 2d edition, 1810, 205.
Ardea egretta, Gm. Syst. Nat. I, 1788, 629.
Gay, Fauna Chilena, Aves, 410.
Egretta leuce, Bonap. Comp. List. 1838, 47.
Ardea leuce, (Illiger.) Bonap. as above.
Vulg. *Greater White Heron. Garza grande.*
Figures.—Wilson, Am. Orn. VII, Pl. lxi, Fig. 4.
" Aud. B. of Am. Pl. ccclxxxvi; oct. ed. VI, Pl. ccclxx.

Several specimens of this fine Heron in the collection of the Expedition are precisely similar to the bird of North America; and as the description of Molina, cited above, appears to have been intended for this species, we have adopted it. It is abundant at some seasons in Chile, frequenting the vicinity of the rivers.

EGRETTA THULA, (Molina.)

Ardea thula, Mol. Sagg. Stor. Nat. Chili, 1782; 2d edition, 1810, 205.
Ardea candidissima, Gay, Fauna Chilena, Aves, 411.
Vulg. *Lesser White Heron. Garza Chica.*

This is a small white species, nearly related to the Snowy Heron of North America, (*Egretta candidissima*). It is frequently met with in Chile, and appears to be a constant resident, inhabiting the vicinity of rivers and marshes.

Of this and other species of Herons Lieut. Gilliss observes: "They name three species of *Garzas* in Chile: *Garza grande*, *Garza chica*, and *Garza*, of which the last must be intermediate in size between the great and small. These birds are common at all seasons about the banks of the fresh-water streams and lakes of the interior, and may frequently be seen in bands of fifteen or twenty."

NYCTICORAX GARDENI, (Gmelin.)

Ardea Gardeni, Gm. Syst. Nat. I, 1788, 645.
Ardea cyanocephala, Molina, Sagg. Stor. Nat. Chili, 1782.
Nycticorax americanus, Bonap. Comp. List. 1838, 49.
Ardea nycticorax, (Linn.) Wilson, Audubon, and other authors.
Nycticorax nævius, Gay, Fauna Chilena, Aves, 422.
Vulg. *American Night Heron. Guairabo.*
Figures.—Wilson, Am. Orn. VII, Pl. lxi.
" Aud. B. of Am. Pl. 236; oct. ed. VI, Pl. ccclxiii.

This bird appears to be specifically identical with that of North America, and is common in western South America.

BOUTAURUS EXILIS, (Gmelin.)

Ardea exilis, Gm. Syst. Nat. I, 1788, 645.
Gay, Fauna Chilena, Aves, 411.
Vulg. The *Least Bittern*. *Guairabo amarillo.*
Figures.—Wilson, Am. Orn. VIII, Pl. lxv, Fig. 4.
" Aud. B. of Am. Pl. ccx; oct. ed. VI, Pl. ccclxvi.

Specimens in the collection appear to be identical with others obtained in Pennsylvania, but are not in mature plumage. This bird, according to Lieut. Gilliss, whose information is from Señor Salinas, is exceedingly rare in Chile. It was a present from Señor S.

SCOLOPAX PARAGUAYÆ, Vieill.

Scolopax paraguayæ, Vieill. Ency. Meth. III, 1823, 1160.
Gallinago paraguiæ, (Vieill.) Gay, Fauna Chilena, Aves, 426.
Vulg. *Avecasina.*

Like its near relative of the north, *Scolopax Wilsonii*, this bird inhabits marshes and other localities in the neighborhood of streams of water, though not stated to be abundant.

RHYNCHŒA SEMICOLLARIS, (Vieill.)

Totanus semicollaris, Vieill. Nouv. Dict. VI, 1816, 402.
Rhynchæa semicollaris, Gay, Fauna Chilena, Aves, 429.
Rhynchæa occidentalis, King, Zool. Jour. IV, 1829, 94.
Vulg. *Painted Snipe. Avecasina pintada.*
Figure.—Lesson, Ill. Zool. Pl. xviii.

This very handsome Snipe is abundant throughout the country. Several specimens in the collection are labelled as having been obtained in the vicinity of Santiago.

NUMENIUS HUDSONICUS, Lath.

Numenius hudsonicus, Lath. Ind. Orn. II, 1790, 712.
Gay, Fauna Chilena, Aves, 419.
Scolopax borealis, Wils., Am. Orn. VII, 1813, 22.
Vulg. *Short-billed Curlew. Perdiz del mar.*
Figures.—Wils. Am. Orn. VII, Pl. lvi, Fig. 1.
" Aud. B. of Am. Pl. ccxxxvii; oct. ed. VI, Pl. ccclvi.

Several specimens in the collection.

CALIDRIS ARENARIA, (Linn.)

Tringa arenaria, Linn. Syst. Nat. I, 1766, 251.
Charadrius calidris, Linn. Syst. Nat. I, 1766, 255.
Calidris tringoides, Vieill. Gal. des Ois. II, 1825, 95.
Vulg. *Sanderling. Pollito blanco.*
Figures.—Vieill. Gal. Pl. ccxxxiv.
" Wils. Am. Orn. VII, Pl. lix, Fig. 4.
" Aud. B. of Am. Pl. ccxxx; oct. ed. V, Pl. cccxxxviii.

Strictly similar to the bird of North America in the plumage, and usually met with in winter.

PELIDNA PECTORALIS, (Say.)

Tringa pectoralis, Say, Long's Exp. I, 1823, 171.
Vulg. *Pollito negro.*
Figures.—Bonap. Am. Orn. IV, Pl. xxiii, Fig. 2.
" Aud. B. of Am. Pl. ccxciv; oct. ed. V, Pl. cccxxix.

Several specimens of both sexes.

HIATICULA TRIFASCIATA, (Licht.)

Charadrius trifasciatus, Licht. Verz. 1823, 71.
Charadrius falklandicus, Lath. Ind. Orn. II, 1790, 747?.
Charadrius annuligerus, Wagler, Syst. Av. 1827?.
Vulg. *Banded Plover. Angelito.*

The best characterized and most mature specimens of this handsome little species that we have ever seen are in the present collection, and were obtained in the vicinity of Santiago.

It is probable that all the above named are synonymes, and that others are to be added in the study of this bird in its various ages and stages of plumage.

HIATICULA AZARÆ, (Temm.)

Charadrius Azaræ, Temm. Pl. col. V, 1823, 31.
Charadrius collaris, Vieill. Nouv. Dict. XXVII, 1818, 136.
Vulg. *Azara's Plover.*
Figure.—Temm. Pl. V, Pl. clxxxxiv.

The specimens in the collection of the Expedition are in the plumage of young birds.

VANELLUS CAYANNENSIS, (Gmelin.)

Parra cayanensis, Gm. Syst. Nat. I, 1788, 706.
Vanellus cayennensis, (Gmel.) Gay, Fauna Chilena, 400.
Charadruis lampronotus, Wagler Syst. Av. 1827, (not paged.)
Vulg. *South American Lapwing. Queltregue.*
Figure.—Buff. Pl. Enc. 836.

This handsome bird extends its range over nearly the whole of the northern part of South America.

Specimens in the collection of the Expedition were obtained in the interior of Chile. Lieutenant Gilliss observes: "This bird is usually found in marshy grounds formed by the overflowing of the irrigating canals or on river banks. It is very common from Coquimbo southwardly. When disturbed, it utters a disagreeable cry, not unlike *Kil-te-hue,* and this may be heard at all hours of the day or night in the districts that it frequents.

RALLUS CÆSIUS, (Spix.)

Gallinula Cæsia, Spix Av. Bras. II, 1825, 73.
Rallus bicolor, Cuv. Gay Fauna Chilena, Aves, 434.

VULG. *Hoary Rail. Pollola. Piden.*
FIGURES.—SPIX Av. Bras. II, Pl. lxlv.
" GAY'S Chile, Aves, Pl. (not numbered.)

One specimen only of this species is in the collection, and is labelled as having been obtained in the interior of Chile.

GALLINULA CRASSIROSTRIS, (Gray.)

Fulica crassirostris, GRAY, Griff. Cuv. III, 1829, 542, (plate.)
Gallinula crassirostris, (GRAY) GAY, Fauna Chilena, Aves, 436.
VULG. *Thick-billed Gallinule. Taguita.*
FIGURE.—GAY'S Chile, Aves, Pl. (not numbered.)

This handsome Gallinule is of frequent occurrence throughout the country. It inhabits the vicinity of the water-courses and marshes in the interior.

HIMANTOPUS NIGRICOLLIS, Vieill.

Himantopus nigricollis, VIEILL. Nouv. Dict. X, 1817, 42.
GAY, Fauna Chilena, Aves, 424.
Charadrius hymantopus, LINN. Syst. Nat. I, 1766, 255.
VULG. *Perrito. The Stilt.*
FIGURES.—WILSON Am. Orn. VII, Pl. lviii, Fig. 2.
" AUD. B. of Am. Pl. cccxxviii; oct. ed. VI, Pl. ccclv.

Specimens in the collection are strictly identical with the species of North America. It is stated to be frequently met with in Chile.

FULICA CHILENSIS, Gay.

Fulica chilensis, GAY Fauna Chilena, (plate only.)
VULG. *Chilian Coot. Tagua.*
FIGURE.—GAY'S Chile, Aves, Pl. (not numbered.)

Several specimens inthe collection of the Expedition appear to be this species, and are labelled as having been obtained in the vicinity of Santiago.

CICONIA PILLUS, (Molina.)

Tantalus pillus, MOL. Sagg. Chile, 1782.
Ardea maguari, GM. Syst. Nat. I, 1788, 623.
Ciconia maguaria, GAY, Fauna Chilena, Aves, 415.
VULG. *American Stork. Pillo.*
FIGURE.—SPIX Av. Bras. II, Pl. lxxxix.

A fine species of Stork, well known as a bird of South America, and which appears to occur throughout nearly the whole of that portion of this continent. It frequents marshes and swamps, and feeds on crustacea and other aquatic animals. In Chile it is stated to be rather an unusual bird.

IBIS MELANOPIS, (Gmelin.)

Tantalus melanopis, Gm. Syst. Nat. I, 1788, 653.
Ibis melanopis, (Gm.) Gay, Fauna Chilena, Aves, 417.
Vulg. *Black-faced Ibis. Bandurria.*
Figure.—Buff. Pl. Enl. 976.

This Ibis is frequently met with in the interior. Specimens in the collection are labelled as having been obtained in the mountains.

IBIS GUARAUNA, (Linn.)

Scolopax guarauna, Linn. Syst. Nat. I, 1766, 242.
Tantalus chalcopterus, Temm. Pl. col. V. p. (liv. 86.)
Ibis falcinellus, Temm. Gay Fauna Chilena, Aves, 416.
Vulg. *Southern Glossy Ibis. Cuervo.*
Figure.—Temm. Pl. col. 511.

A species nearly related to, but apparently distinct from, the *Ibis Ordii* of North America. It is of common occurrence in the countries of western South America, and has been met with in Mexico, and northwardly within the limits of the United States.

In Chile the present bird at some seasons congregates in flocks of considerable size, and migrates southward. Lieutenant Gilliss observes of this species: "I will not say that this bird keeps company with the *garzas*, but it is constantly seen in the same localities, apparently on the most friendly terms."

PLATALEA AJAJA, Linn.

Platalea ajaja, Linn. Syst. Nat. I, 1766, 231.
Gay, Fauna Chilena, Aves, 414.
Vulg. *Roseate Spoonbill. Planeta. Cuchareta. Espatula.*
Figures.—Buff. Pl. Enl. 165.
" Wilson Am. Orn. VII, Pl. lxiii.
" Aud. B. of Am. Pl. cccxxi; oct. ed. VI, Pl. ccclxii.

The Spoonbill extends its range of locality over a vast extent of the continent of America, embracing the southern portion of the United States, and nearly the whole of South America. Several specimens in the present collection were obtained in the interior. According to Lieut. Gilliss, this fine bird remains in the vicinity of some of the lakes of Chile during the breeding season.

HÆMATOPUS PALLIATUS, Temm.

Hæmatopus palliatus, Temm. Man II, 1820, 532.
Gay, Fauna Chilena, Aves, 406.
"*Hæmatopus ostralegus*, Linn." Wilson Am. Orn. VIII, 15.
Vulg. *Oyster-catcher. Tira-tira.*
Figures.—Wilson Am. Orn. VIII, Pl. lxiv, Fig. 2.
" Aud. B. of Am. Pl. ccxxiii; oct. ed. V, Pl. ccexxiv.
" Jard. and Sel. Ill. Pl. vii.

Specimens in the collection do not differ from the bird of North America.

HÆMATOPUS ATER, Vieill.

Hæmatopus ater, Vieill. Gal. II, 1825, 88, Pl. ccxxx.
Hæmatopus niger, Cuv. Reg. An. I, 1829, 504.
Gay, Fauna Chilena, Aves, 406.
Hæmatopus Townsendii, Aud. Orn. Biog. V, 1839, 247.
Vulg. *Black Oyster-catcher. Perpilen.*
Figures.—Quoy and Garn. Voy. Uranie, Birds, Pl. xxxiv.
" Aud. B. of Am. Pl. ccccxxvii; oct. ed. V, Pl. ccccxxvi.

This bird inhabits very nearly the entire western coast of the continent of America, specimens from Oregon being in the collection made by Dr. Townsend in that country, and from Tierra del Fuego in that of the United States Exploring Expedition of the Vincennes and Peacock. It occurs sparingly in Chile.

PHŒNICOPTERUS IGNIPALLIATUS, Is. Geoffr.

Phœnicopterus ignipalliatus, Is. Geoff. et D'Orb. Mag. de Zool. 1832, Ois. Pl. ii.
Gay, Fauna Chilena, Aves, 441.
Phœnicopterus Chilensis, Molina. ?
Vulg. *Flamenco. Cheuque.*
Figure.—Gray Gen. of Birds III, Pl. clxiii.

Of this beautiful species numerous specimens are in the collection of the Expedition.

This bird is thus noticed by Lieutenant Gillis: "These birds are quite abundant on the interior fresh-water lakes, and I found a large flock of them on the shores of the river Maule. They are rarely molested, except to add to the collections of ornithologists.

"The plumage of the young bird differs in color materially from that of the adult, as may be seen in some of our specimens."

PHŒNICOPTERUS ANDINUS, Philippi.

Phœnicopterus andinus, Philippi, Descr. en An. de la Univ. de Chile.
Vulg. *Parrina.*

In the "Anales de la Universidad de Chile" for August, 1854, a *Phœnicopterus* found by Dr. R. A. Philippi in the desert of Atacama is thus described by him:*

"When I undertook the journey to the desert of Atacama, I was far from suspecting that in these arid regions I should find a new species of aquatic bird. Nevertheless, the first objects that presented themselves to my sight, on descending from the gloomy heights of Pingo-pingo, and reaching the great salt-marsh extending for twenty-five leagues to the hamlet of Atacama, were a dozen flamingos which sought food in the muddy ditches there. It is well known to the people of the vicinity that the species differs from the common flamingo, they calling it *Parrina*. According to the information I have been able to collect, these birds live exclusively in the cordilleras, maintaining themselves in the lakes and swamps that are found in the desert. I have not been able to verify whether they exist much to the north of Atacama, but it appears that the cordilleras of Copiapó is the southern limit frequented by them. They lay their eggs on the shores of the most elevated lakes of the cordilleras in the month of December, and at that epoch the Indians who inhabit the vicinity take them in abundance to the market at Atacama. We killed one specimen on arriving and two when returning, and which served to vary somewhat our frugal and monotonous repast; a *cazuela* being made of the birds, which

* On referring this interesting description to Mr. Cassin, he coincided with me, that it merited insertion here.—J. M. G.

was not bad. Nevertheless, at first I could not eat of it without some repugnance, because the fat of the *Parrina* has the uncommon color of cinnabar. On returning, I examined the Parrina carefully, and recognised immediately that it was of a species very different from the four flamingos known; and, notwithstanding that there were no books on the subject accessible, I did not hesitate to say, that the bird had hitherto remained entirely unknown to naturalists.

"The genus Flamingo, distinguished so eminently from all other birds, that it is impossible to confound them, embraces only four species, as I have just said. The first is the *Phœnicopterus ruber*, which inhabits the south of Europe and opposite coast of Africa; the second is the *P. bahamensis* of Catesby, found in the Antilles and vicinal portions of the continent of America; the third is the *P. ignipalliatus* of Isidro Geoffroy St. Hilaire, the common flamingo of Chile, equally found in Buenos Ayres and generally in the southern part of America; and the fourth is the *P. minor* of Geoffroy St. Hilaire, which is found in southern Africa as far as Senegal. I must observe that Don Juan Ignacio Molina describes a fifth species under the name of *Phœnicopterus chilensis*, (see his Saggio sulla Storia Naturale del Chile, Bologna, 1782, p. 212,) assigning it *white* wing-quills. But this estimable writer was not a naturalist, and, from all evidences, described nearly every animal and plant of Chile from memory; necessarily committing many errors, and causing the enumeration of several genera and species in works on natural history which have no actual existence. The *Phœnicopterus chilensis* of Molina is one of these. The author was wrong in giving it white wing-quills, whilst they were black, as on all the other flamingos; and he was not less in error when he states, in the page referred to, 'it is said that these birds when young are of a gray color, but I have seen both young and full-grown, and have found them uniformly of the same color'—that is to say, red. The young flamingos of Chile are gray, like those of Europe.

"The flamingo of the desert cannot be mistaken either for the *P. ruber* of Europe or the *P. bahamensis* of the Antilles, because these species have characteristics sufficiently different. Moreover, it is essentially distinct from the *P. ignipalliatus* of South America. At the first glance it is seen to be smaller and of a different color. The neck and breast have a color approaching carmine, or somewhat resembling the lees of wine. The red color of the wing coverts is much darker; not only the primary and secondary wing-quills being of that color, but also the tertiary. The feet also are of a very different color—that is to say, they are of a pale yellow—and the mandibles have a red-colored portion between the black extremity and their yellow base. To this it may be added that the tail is longer than the extremities of the wings.

"But the *Parrina* offers differences much more essential. The bill has a very diverse conformation, being much wider; the upper mandible (*quijada*) is greatly more depressed, and the inferior much narrower than the upper, whilst there is no such inequality in the common flamingo. In the Parrina the feathers extend to the angle where the two branches of the lower jaw unite, and even beyond it; in the flamingo, on the contrary, they do not come so far, but leave the skin there bare for more than half an inch. The feet also differ essentially, wanting the hind toe which is very manifest in the flamingo. The differences of the bill and feet are sufficient to establish a sub-genus, and perhaps a new genus, but I leave this to the taste of those who think that the merits of a naturalist consist in fabricating the greatest possible number of new genera.

"According to the brief notices of it obtainable from the books within my reach, the *Phœnicopterus minor* appears to have a bill formed nearly as that of the Parrina; but that bird is said to have alternate bands of red and black colors in the superior wing coverts, and red feet, so that it cannot be confounded with the latter.

"As the *Parrina* does not leave the elevations of the cordilleras, it appears proper to call it *Phœnicopterus andinus;* and I give the following diagnosis of it: *Ph. roseo-albus; parte inferiore colli pectoreque fere puniceis; alis coccineis, apice toto nigris; cauda alis longiore, acuminata*

rostro dilatato, turgido, basi flavo, medio rubro, apice nigro; mandibula superiore multo angustiore quam inferior; pedibus tridactylis, flavis.

"Mean dimensions of three individuals:

Length from base of bill to apex of tail	$35\frac{1}{2}$	inches.
Length of the bill along the upper mandible	$4\frac{3}{4}$	"
Length of the os tibiæ	$9\frac{1}{2}$	"
Length of the torsal	9	"
Length of the middle toe	$2\frac{1}{2}$	"

"I may add that the total length varies between 34 and $36\frac{3}{4}$ inches, and that of the *os tibiæ* between $8\frac{3}{4}$ and $10\frac{3}{4}$; which is very remarkable. The three individuals were males.

"P. S.—After having written this notice, there fell in my hands an account of the province of Tarapacá, by Mr. William Bollaert, read at a meeting of the Royal Geographical Society of London. In this paper the author states that he found on lakes of the cordilleras of that province 'flamingos with red breasts,' and on the map accompanying the memoir there is a lake called *Las Parrinas*, in latitude 19° south. I immediately conjectured that this flamingo of the cordillera of Tarapacá with the red breast was my *Phœnicopterus andinus*, and having had the pleasure to see Mr. Bollaert in Santiago, and show him my mounted specimen in the museum, this gentleman confirmed me that it is the same species; so that we may assign for its habitation the whole cordilleras from latitude 19° south to 27° south."

Order V. NATATORES.

CYGNUS NIGRICOLLIS, (Gmelin.)

Anas nigricollis, Gm. Syst. II, 1788, 502.
Cygnus nigricollis, (Gm.) Gay, Fauna Chilena, Aves, 445.
Vulg. *Black-necked Swan. Cisne.*
Figure.—Gay, Historia Fisíca y Politíca de Chile, Atlas, Orn. Pl. (not numbered.)

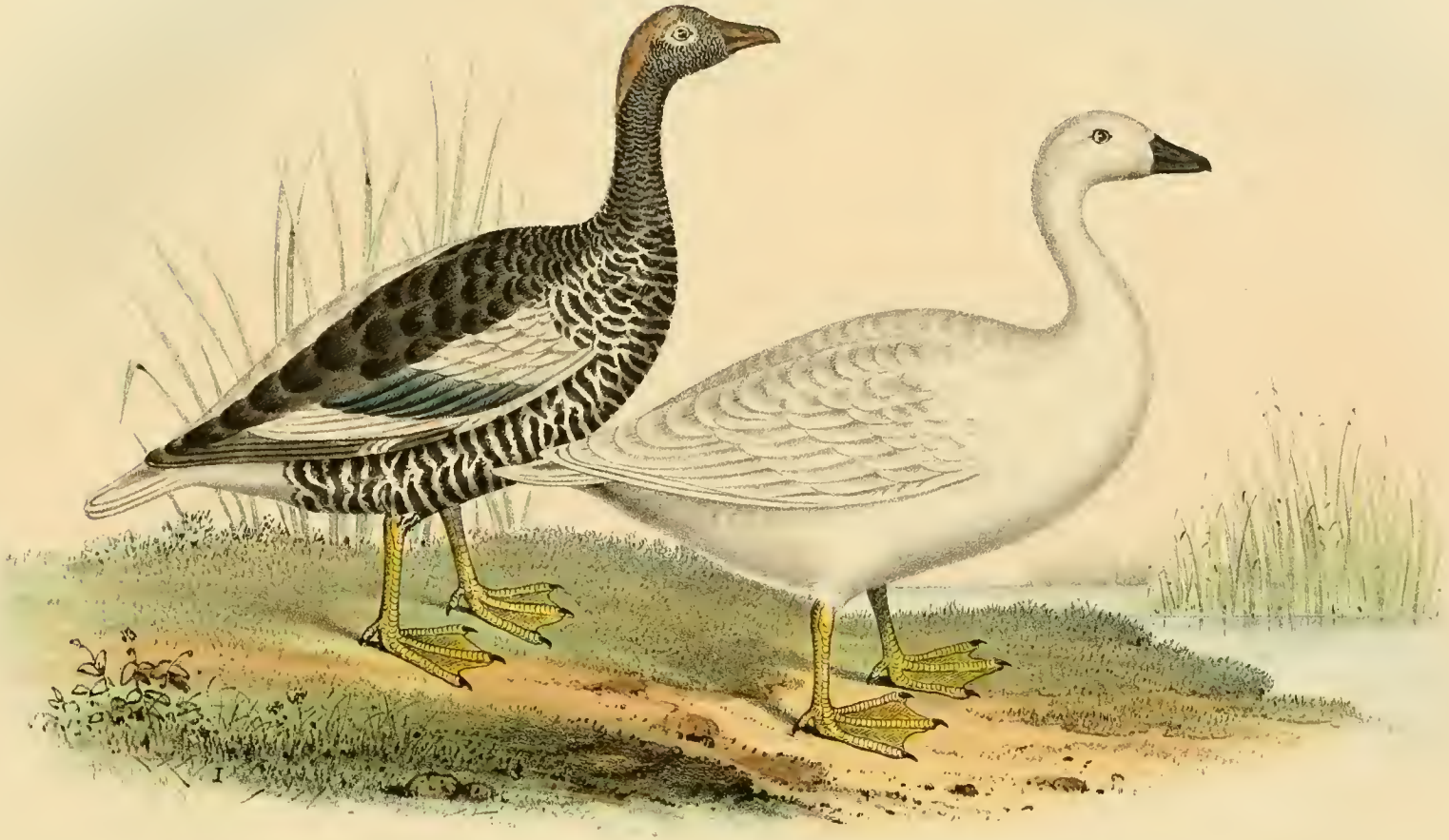
This fine Swan, remarkable for its black head and neck, which strongly contrast with the snowy whiteness of the plumage of the other parts of its body, is frequently met with in the rivers and lakes. It appears to be restricted to the countries of western South America.

Numerous specimens of this bird are in the collection of the Expedition. The female scarcely differs from the male, except in somewhat smaller size, and in having the protuberance at the base of the upper mandible less strongly developed. Lieutenant Gilliss observes: "This bird abounds most in the small mountain lakes, on the shores of which it builds its nest. I have never seen it on the seacoast. It is shorter necked and shorter legged than the North American swan, and but for the agreeable contrast of its colors, would have nothing to redeem its awkward movements and ungraceful figure on land. It is easily tamed, my friend, Mr. Salinas, near Santiago, having several in an artificial lake in his garden. It lays six to eight eggs of a dirty bluish white color."

BERNICLA ANTARCTICA, (Gmelin.)

Plate XXIII. Male and female.

Anas antarctica, Gm. Syst. Nat. I, 1788, 505.
Gay, Fauna Chilena, Aves, 442.
Anas ganta, Forst. Desc. An. 1844, 336.
Vulg. *Antarctic Goose.*



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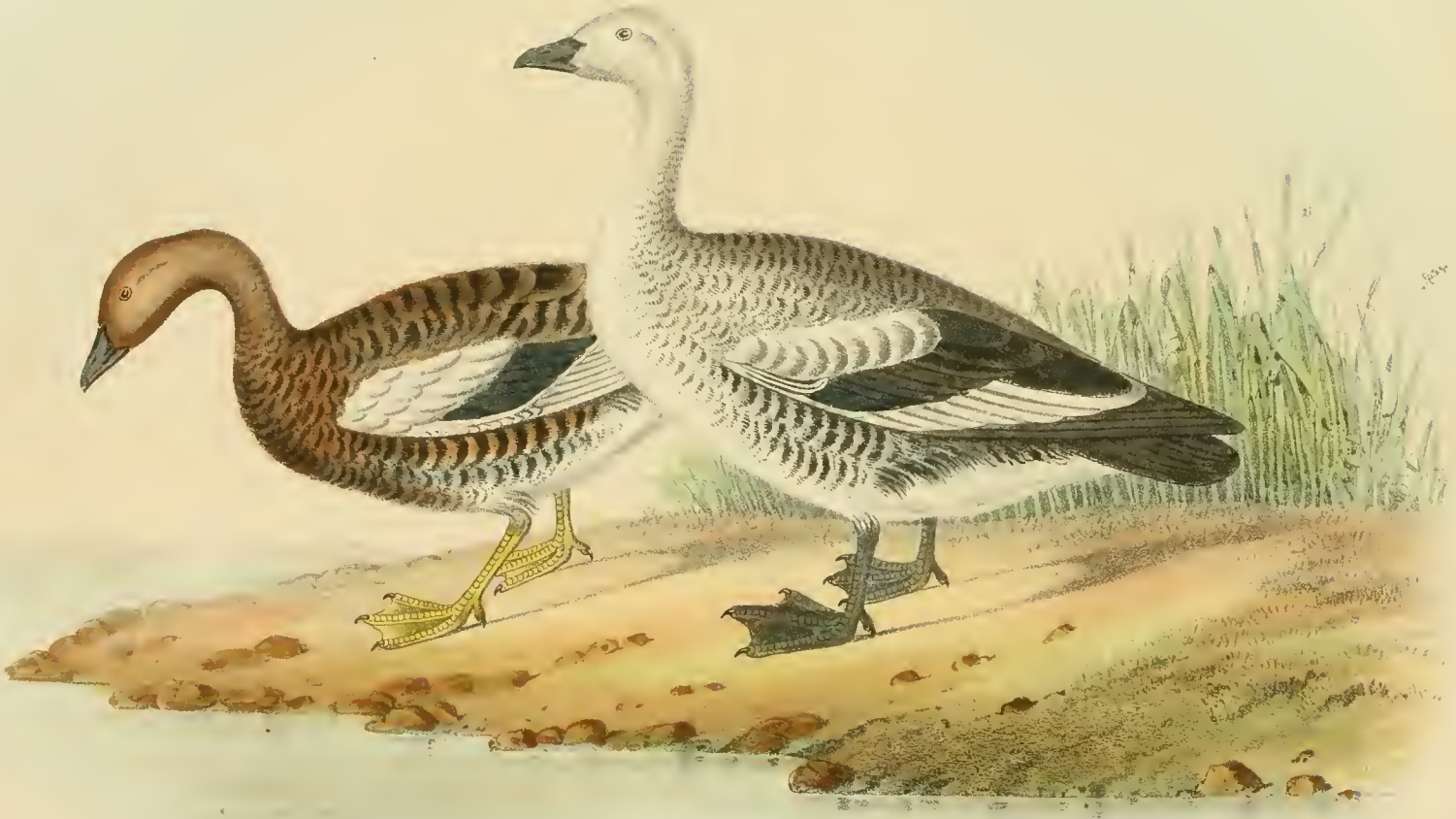
BERNICLA ANTARCTICA. (G.m)



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BERNICLA MAGELLANICA (Gm.)

Male and Female.

The coast of Chile appears to be the most northern locality visited by the beautiful species of goose now before us.

The difference in the colors of the sexes on this species is very remarkable, and quite unusual in birds of this group. The male in mature plumage is perfectly white, while the female presents the varied colors represented in our plate. It is one of the most handsome of the birds of this family, and appears to be of rather common occurrence on the southerly coast of South America.

BERNICLA MAGELLANICA, (Gmelin.)

PLATE XXIV. Male and female.

Anas magellanica, GM. Syst. Nat. II, 1788, 505.
Bernicla magellanica, (GM.) GAY, Fauna Chilena, Aves, 443.
VULG. *Magellanic Goose. Gancillo.*

Frequently met with in Chile, though apparently only during its migrations. Specimens in the collection are labelled as having been obtained in the interior.

The females in all the specimens before us are uniformly different in colors from the males. Both sexes are represented in our plate. One specimen in the collection which we regard as a young male, has the breast and sides striped transversely with brownish black, similar to the markings of the upper parts of the body.

BERNICLA MELANOPTERA, (Eyton.)

Anser melanopterus, EYTON, Monog. Anat. 1838, 93.
Bernicla melanoptera, (GRAY) GAY, Fauna Chilena, Aves, 443.
FIGURE.—Voy. Beagle, Birds, Pl. 1.
VULG. *Black-winged Goose. Piuquen.*

This species, like that immediately preceding, appears to be an inhabitant of the interior of the country. It seems to be a constant resident in Chile, frequenting the plains, and, as indicated by labels on specimens in the present collection, the lower valleys of the Andes.

According to Lieutenant Gilliss, this goose, and the two preceding species, are found in the lakes of the higher Andes, "perhaps 7,000 feet above the ocean." Of the present bird he observes, "The *Piuquen* frequents a small body of water near the Portillo pass in such numbers that it gives name to it, 'Valle de los Piuquenes.'"

MARECA CHILOENSIS, (King.)

Anas chiloensis, KING, Proc. Zool. Soc. London, 1830, 15.
Mareca chiloensis, (EYTON) GAY, Fauna Chilena, Aves, 447.
VULG. *Chile Widgeon. Pato real.*
FIGURE.—Eyton, Monograph, Pl. xxi.

This beautiful species, which in Chile bears the popular name of *Pato real*, or Royal Duck, apparently in no very unjust allusion to its handsome plumage and graceful form, appears to be of frequent occurrence in the rivers and lakes of that country. It is one of the several species that we especially wish to see ranked as birds of the United States.

ANAS OXYURA, Meyen.

Anas oxyura, Meyen, Nov. Act. XVI, 1834, 122.
Gay, Fauna Chilena, Aves, 449.

Apparently a frequent species, several fine specimens being in the present collection.

ANAS SPECULARIS, King.

Anas specularis, King, Zool. Jour. IV, 1828, 98.
Gay, Fauna Chilena, Aves, 450.
Anas specularoides, King, Zool. Jour. IV, 98.
Anas chalcoptera, Kittlitz, Mem. Acad. St. Peters. II, 1834, 471.
Vulg. *Pato anteojillo.*
Figures.—Jard. and Sel. Ill. Orn. n. s. Pl. xl.
" Kittl. Mem. Acad. St. Peters. II, Pl. v.

A single specimen in the present collection is labelled as having been obtained in the interior. "Though common," observes Lieut. Gilliss, "it is found only about streams; not in the lakes. Its name comes from the white spots just over the eyes."

ANAS MELANOCEPHALA, Vieill.

Plate XXV. Adult.

Anas melanocephala, Vieill. Nouv. Dict. V, 1816, 163.
Vulg. *Pato rinconero.*

Form short, stout; bill rather long; nail very distinct; wings moderate, second quill longest; tail short. Entire head brownish black. Upper parts of the body brown, finely mottled with pale fulvous, the latter (fulvous) predominating on the neck, and forming a wide ring around it. Wings dark brown, sprinkled with minute points of silvery white; secondaries and greater wing coverts tipped with white; tail dark brown. Under parts of the body silvery white; sides and flanks finely mottled with light fulvous; under coverts of the tail rufous. Edges of the wings and under wing coverts white. Bill dark, with a large spot of orange at base; legs and feet lighter.

One specimen only of this species is in the collection, and is labelled as having been obtained in the interior. We have no doubt that this is the bird meant by Vieillot in the description above cited, though the species appears to have been lost sight of by late ornithologists.

QUERQUEDULA CYANOPTERA, (Vieill.)

Anas cyanoptera, Vieill. Nouv. Dict. V, 1816, 104.
Anas Rafflesii, King, Zool. Jour. IV, 1528, 97.
Pterocyanea cæruleata, (Licht.) Gray, Gen. II, 1845, 617.
Querquedula cæruleata, (Licht.) Gay, Fauna Chilena, Aves, 452.
Vulg. *Red Teal. Pato colorado.*
Figures.—Cassin, B. of California and Texas, I, Pl. xv.
" Jard. and Sel. Ill. Orn. n. s. Pl. xxiii.

This beautiful little Teal ranges over a vast extent of the western part of the continent of America, having been observed so far north as the Great Salt lake by Capt. Stansbury, and

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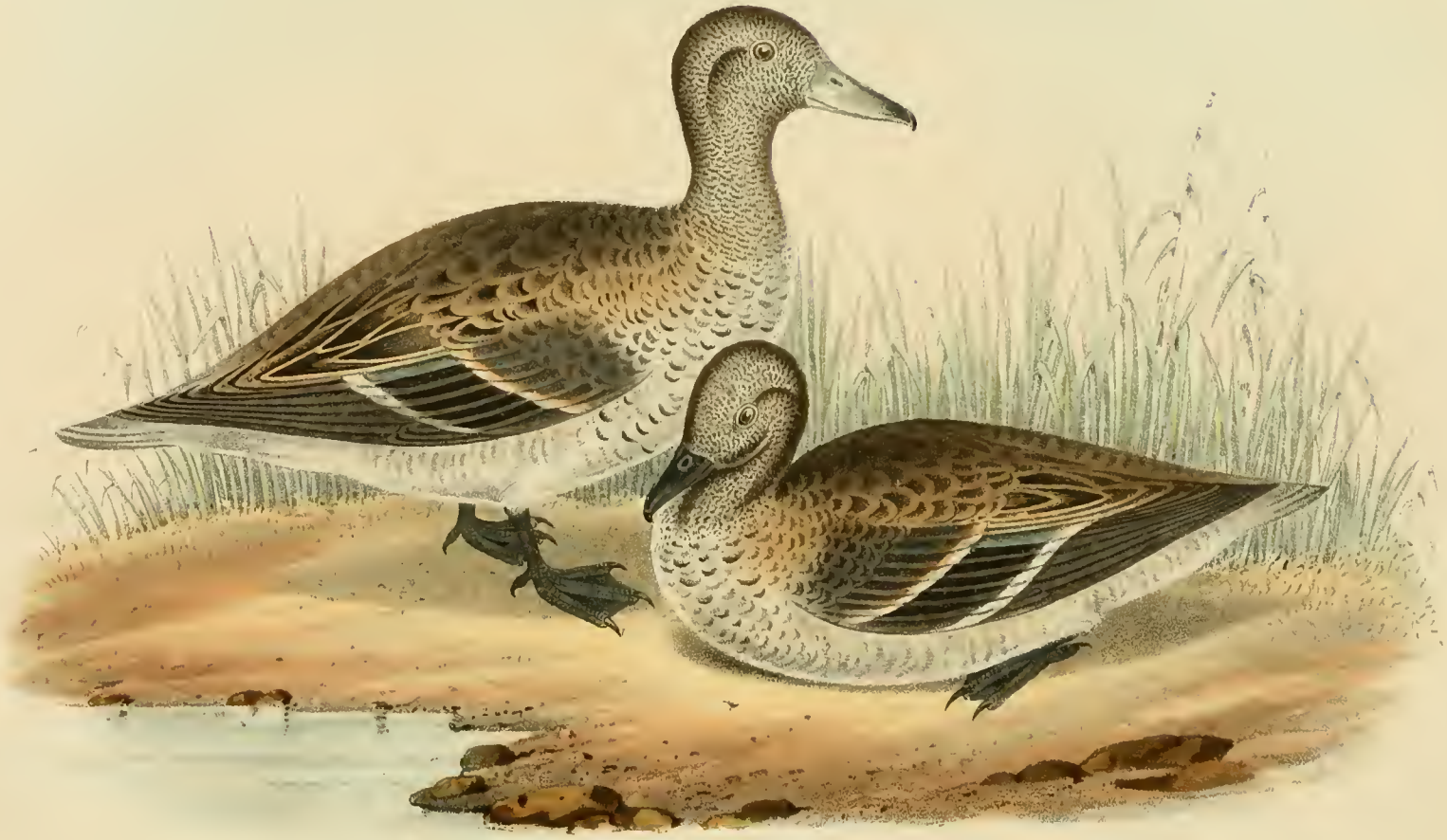
ANAS MELANOCEPHALA VIEILLOT.



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QUERQUEDULA CRECCOIDES. (King.)

well known as a bird of California, and in the course of its winter migration visits the shores and lakes of Chile.

Specimens in the collection are in very nearly the same plumage as others from western North America obtained in spring, and those labelled as females differ in colors entirely from the males, being as represented in the plate of our work above cited.

This bird inhabits fresh waters; generally observed in the smaller streams.

QUERQUEDULA VERSICOLOR, (Vieill.)

Anas versicolor, VIEILL. Nouv. Dict. V, 1816, 109.
Anas fretensis, KING, Proc. Zool. Soc. London, 1830, 15.
Anas maculirostris, LICHT. Verz. 1823, 84.
Querquedula maculirostris, (LICHT.) GAY, Fauna Chilena, Aves, 453.
VULG. *Pato Capuchino.*
FIGURE.—JARD. and SELBY, Ill. Orn. new series, I, Pl. xxix.

This handsome Teal, though of frequent occurrence in some of the countries of South America, is more rare in Chile. Specimens in the present collection are from the vicinity of Santiago.

QUERQUEDULA CRECCOIDES, (King.)

PLATE XXVI.

Anas crecciodes, KING, Zool. Jour. IV, 1828, 99.
Anas oxyptera, MEYEN, Nova. Acta. XVI, 1832, 121.
Querquedula creccoides, (EYTON) GAY, Fauna Chilena, Aves, 453.
VULG. *South American Teal. Pato gergon chico.*

Notwithstanding the fact that specimens in the collection of this Expedition are labelled as males and females, all the specimens of this bird that we have ever seen have the appearance to us of being immature. Nor is any other plumage described by naturalists. In fact we regard this bird as a species the adult of which is probably unknown, though perhaps migrating in the summer to the western countries of North America.

All the species of the group to which this bird belongs are characterized by plumage of unusual beauty of colors when mature. The discovery, therefore, of the adult of this species is a point of much interest, especially if added to the ornithological fauna of the United States.

Inhabits fresh water, and is at times abundant in Chile.

DAFILA BAHAMENSIS, (Linn.)

Anas bahamensis, LINN. Syst. Nat. I, 1766, 199.
Dafila bahamensis, (GRAY) GAY, Fauna Chilena, Aves, 448.
Anas urophasianus, VIG. Zool. Jour. IV, 1829, 357.
VULG. *Pato jergon grande.*
FIGURES.—CATESBY'S Carolina, I, Pl. xciii.
" EYTON'S Morv. Pl. xx.
" Voy. Blossom, Birds, Pl. xiv.

This fine Duck, a near relative of the common Pintail (*Dafila acuta*) of the United States, is one of the southern species which are known to visit the coast of California, and probably breeds in the northern regions of western North America. It is a common species in Chile at some seasons.

FULIGULA METOPIAS, (Pœppig.)

PLATE XXVII. Male and female.

Fuligula metopias, (PŒPP.) GAY, Fauna Chilena, Aves, 456.
Anas metopias, (PŒPP.) FRORIEP'S Notzen, 1829, No. 529.
VULG. *Pato sin cresta.*

Of this apparently little known species several fine specimens are in the present collection, and it is represented as not of rare occurrence. The male is remarkable for a conspicuous protuberance in front at the base of the upper mandible. In the female this part is elevated only. Adult birds of both sexes are figured in our plate.

ERISMATURA FERRUGINEA, Eyton.

Erismatura ferruginea, EYTON, Mon. Anat. 1838, 170.
GAY, Fauna Chilena, Aves, 458.
VULG. *Pato Pimpillo.*
FIGURE.—GRAY, Genera III, Pl clxix.

Several specimens are in the present collection, though apparently this species is not of common occurrence in Chile.

MERGANETTA ARMATA, Gould.

Merganetta armata, GOULD, Proc. Zool. Soc. London, 1841, 95.
Raphipterus chilensis, GAY, Fauna Chilena, Aves, 459.
VULG. *Pato de la Cordillera.*
FIGURES.—DES MURS, Icon. Orn. Pl. vi, xlviii.
" GRAY'S Genera III, Pl. clxx.
" GAY, Fauna Chilena, Aves, Pl.

Female specimens correspond precisely with the description of Mr. Gould and the figure of Des Murs, (Pl. xlviii) as cited above. Gay, in Fauna Chilena, Aves, p. 459, describes the young male as the female. Of the young male, specimens are in the collection of the Philadelphia Academy.

This remarkable bird frequents exclusively the rivers of the Andes, preferring apparently the rapids, and swimming and diving with great facility.

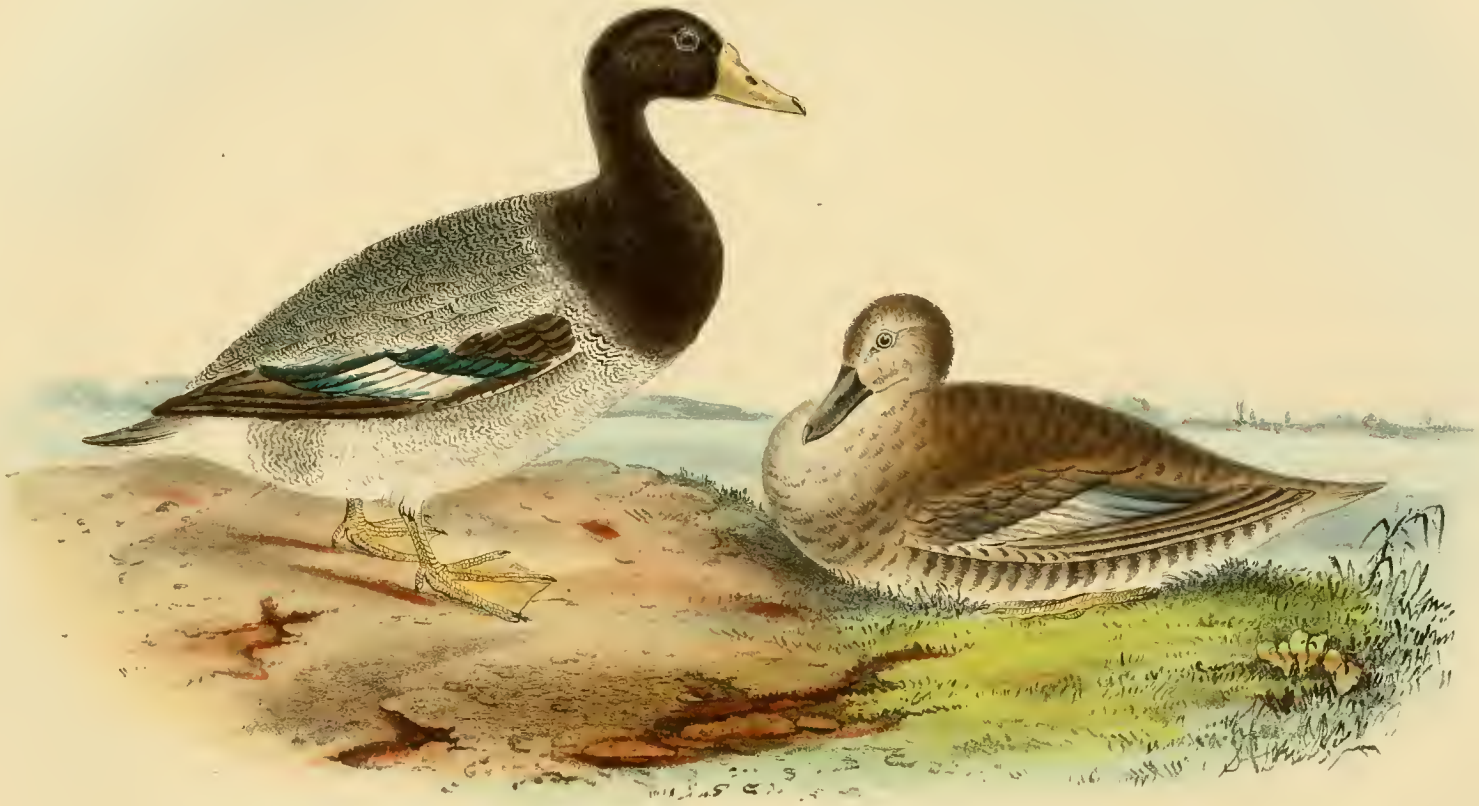
LARUS GLAUCODES, Meyen.

Larus glaucodes, MEYEN, Nov. Act. XVI, 1834, 115, Pl. xxiv.
Larus cirrocephalus, (VIELL.) GAY, Fauna Chilena, Aves, 482.
VULG. *Caguil.*

Stated to be common on the coast, and occasionally ascending the rivers.

LARUS DOMINICANUS, Licht.

Larus dominicanus, (LICHT.) VERZ. 1823, 82.
GAY, Fauna Chilena, Aves, 480.
VULG. *Gaviota grande.*
FIGURE.—GRAY'S Genera III, Pl. clxxx.



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FULIGULA METOPIAS (POEPPIG).

Male and Female

PHALACROCORAX BRASILIANUS. [GM.]

This fine species appears to be of frequent occurrence throughout the western coasts of South America.

LARUS BRIDGESII, Fraser.

Larus Bridgesii, Fraser, Proc. Zool. Soc. 1845, 16.
Larus modestus, Tschudi, Faun. Peru. Aves, 1846, 306, Pl. xxxv.
Gay, Fauna Chilena, Aves, 483.

Of this handsome little Gull, specimens of both sexes are in the collection of the Expedition. Though undoubtedly the species described and figured by Tschudi as above cited, the present specimens are in apparently more mature plumage than those obtained by him on the coast of Peru. Instead of the entire plumage being dark cinereous (or, more properly, plumbeous,) the head in the male specimen now before us is nearly pure white, gradually shading into the dark cinereous, which prevails throughout the entire other plumage. In the female the white of the head is not so clear nor extended, but is still nearly pure in front and on the throat.

Quills black; secondaries tipped with white, forming a conspicuous oblique bar on the closed wing. Rump, upper and under tail coverts cinereous, lighter on the last; inferior coverts of the wing dark plumbeous. Tail, in the male, dark cinereous, with a wide subterminal band of black and tipped with white. In the female the tail is a shade lighter, and the black band is not so wide, and is more irregular and imperfect on the central feathers. Bill and feet black.*

PODICEPS LEUCOPTERUS, King.

Podiceps leucopterus, King, Zool. Jour. IV, 1828, 101.
Gay, Fauna Chilena, Aves, 463.
Vulg. *White-winged Grebe. Guala.*
Figure.—Jard. and Sel. Ill. Orn. III, Pl. cvii.

Appears to be frequently met with on the coast of Chile. Specimens in the collection are essentially as described and figured above.

PODILYMBUS BREVIROSTRIS, Gray.

Podilymbus brevirostris, Gray, Gen. of Birds III, 1846, 633, Pl. clxxii.
Vulg. *Picurio.*

Several specimens, in plumage as represented in the plate above cited, are in the present collection.

PHALACROCORAX BRASILIANUS, (Gmelin.)

Plate XXVIII. Adult male.

Procellaria braziliana, Gm. Syst. Nat. I, 1788, 564.
Phalacrocorax niger, King, Zool. Jour. IV, 1828, 101.

* Of *Larus hæmatorhynchus*, (Vigors,) another species of western South America, though not in the present collection, it may not be inappropriate to say that specimens apparently mature differ essentially from both Mr. Vigors's description and the figure in Jard. & Selb. Ill. Orn. II, Pl. cvi. The head above, back, and wings are dark plumbeous, neck behind throat and entire under parts tinged with cinereous. Rump, upper tail coverts, and tail white; the first tinged with cinereous. Bill and feet bright red; the former large, as described and very correctly represented in the plate just cited. The descriptions and figure referred to relate either to the young bird or to the winter plumage of the species, but are sufficient for its easy recognition.

Graculus brasilianus, (Gm.) Gay, Fauna Chilena, Aves, 490.
Vulg. *Brazilian Cormorant. Yeco.*

This bird appears to be common on the entire western coast of South American. A mature male, from a specimen in the collection of the Expedition, is represented in our plate.

PHALACROCORAX GAIMARDI, (Garnot.)

Pelecanus Gaimardi, Garnot, Voy. Coquille, Zool. I, 1826, 601.
Graculus Gaimardi, (Garn.) Gay, Fauna Chilena, Aves, 489.
Vulg. *Gaimard's Cormorant. Lile.*
Figure.—Voy. Coquille, Zool. Pl. xlviii.

This handsome species, the light cinereous of the plumage of which is an agreeable variation from the sombre colors that prevail in this group, is apparently of frequent occurrence on the Pacific coast of South America and its islands. Specimens of both sexes are in the collection of the Expedition, of which that labelled the female is slightly the larger. In color and other characters they are similar.

PELECANUS THAGUS, Molina.

Pelecanus thagus, Molina, Sagg. Stor. Nat Chili, 1782, quarto ed. 1810, 199.
Gay, Fauna Chilena, Aves, 494.
Pelecanus Molinæ, Gray. Gen. III, 1845, 668.
Vulg. *Alcatraz.*

This interesting species is represented in the present collection by a single specimen only, which is unfortunately not in adult plumage. It is, however, readily to be recognised by the description in the quarto edition of Molina above cited.

It is probable that this bird will be found inhabiting the shores of the Pacific, as far north as the possessions of the United States; other known species being rather remarkable for their extensive dissemination over wide extents of territory. We know nothing of the habits of this bird.

REPTILES.

BY CHARLES GIRARD.

BATRACHIA.

FAMILY OF RANIDÆ.

Genus CYSTIGNATHUS, Wagler.

Gen. char. Vomerine teeth disposed upon a transverse or oblique row more or less interrupted in the middle, and situated either between the inner nares or behind them; tongue circular, subcircular, or subcordiform, posteriorly entire, and either attached by its whole surface or very slightly free behind; tympanum distinct; toes either bordered by a membranous fold or slightly webbed at their base.

Syn. *Cystignathus*, Wagl. Nat. Syst. Amph. 1830, 202.
Grd. Proc. Acad. Nat. Sc. Philad. VI, 1853, 420.

Obs. The genus *Cystignathus* is here admitted within the limits we have recently assigned to it on the occasion of the study which we have made of the species of exotic batrachians brought home by the United States Exploring Expedition, to which we would refer herpetologists.

CYSTIGNATHUS TAENIATUS, Girard.

Plate XXXIV, Figs. 8—11.

Spec. char. Vomerine teeth, situated a little behind the inner nares, well separated upon the middle of the palate; tongue subelliptical, free posteriorly, and slightly notched upon the same margin. Greenish yellow, with two dorsal blackish stripes; limbs barred above. A dark vitta upon the sides of the head, extending from the nostril, across the eye, to the shoulder.

Syn. *Cystignathus taeniatus*, Grd. Proc. Acad. Nat. Sc. Philad. VII, 1854, 226.

Descr. The general appearance of this species is rather short, the head forming about the third of the entire length—the posterior limbs, of course, excepted. The head is longer than broad. The snout is subacute and rounded; slightly declive from the eyes forwards and sideways. The *canthus rostralis* is depressed; the nostrils, very small, are situated nearer to the tip of the snout than to the anterior rim of the orbit. The eye is well developed and subcircular, its longitudinal diameter being equal to the interocular space above; the upper eyelid is minutely granular. The tympanum is quite small, though conspicuous. The tongue is well developed, in the shape of a subelliptical disk, broadest behind, slightly notched posteriorly, and free upon nearly the posterior third of its length. The inner nares are subelliptical, oblique, and conspicuous. The vomerine teeth are exceedingly minute, and disposed upon two very small and subelliptical distant eminences, situated between and a little behind the inner

nares. The openings for the tubes of eustachii are smaller and less conspicuous than the inner nares. The subgular air-bladders are very much developed. The anterior limbs, when stretched backwards alongside with the body, bring the tip of the inner finger close to the groin, beyond which, consequently, the other fingers extend. The fingers are slender, and their tips slightly swollen. The innermost is stoutish, and shorter than the second, which is shorter than the fourth—the third being the longest. The palm of the hand is provided with quite large tubercles; that at the base of the inner finger is the largest of all. The first phalanges are marked beneath by similar tubercles, though more regularly conical in their shape. The tubercles under the second phalanx of the third and fourth fingers are quite reduced. The posterior limbs are long and slender, measuring nearly two inches from their origin to the tip of the longest toe. The foot is narrow, and likewise slender, as well as the toes, which are free, there being but a rudimentary webbing to be observed between the three middle ones. The sole of the foot is smooth; the inner metatarsal tubercle is rather small and conical, and the outermost still smaller and inconspicuous. Small tubercles exist under the articulation of the first and second phalanges, except under the inner toe. The second toe is shorter than the fifth, whilst the third is longer than the latter. The fourth is much the longest. The inferior surface of the thighs alone is granular or warty; the skin elsewhere is perfectly smooth, save minute pores which may be observed about the tympanum and on the sides of the back, where they constitute a narrow band, extending from the occiput to near the groins. The ground color is olivaceous or greenish yellow. The region between and behind the eyes exhibit traces of black markings which cannot be defined upon the specimen before us. There is a black, narrow vitta along the line of the *canthus rostralis*, terminating anteriorly by an expansion over the nostrils posteriorly; the vitta when reaching the eye sends off a tapering branch along the inferior rim of the orbit, behind which the vitta reappears considerably broader, and passing over the tympanum terminates above the insertion of the anterior limbs. From the upper and posterior part of the orbit, above the tympanum, originates a blackish stripe, which extends to the posterior extremity of the body, covering entirely the series of dorsal pores above alluded to. The bands from either side converge in their extension. The limbs above are barred with greyish black. The inferior surface of head, body, and limbs is of a uniform dull yellow hue.

This species was obtained in the vicinity of Santiago, Chile.

Plate XXXIV, fig. 8 represents the profile of *Cystignathus taeniatus*, of the size of life.
fig. 9 is a view from below.
fig. 10, inferior surface of the hand.
fig. 11, inferior surface of the foot.

Figs. 10 and 11 are slightly magnified.

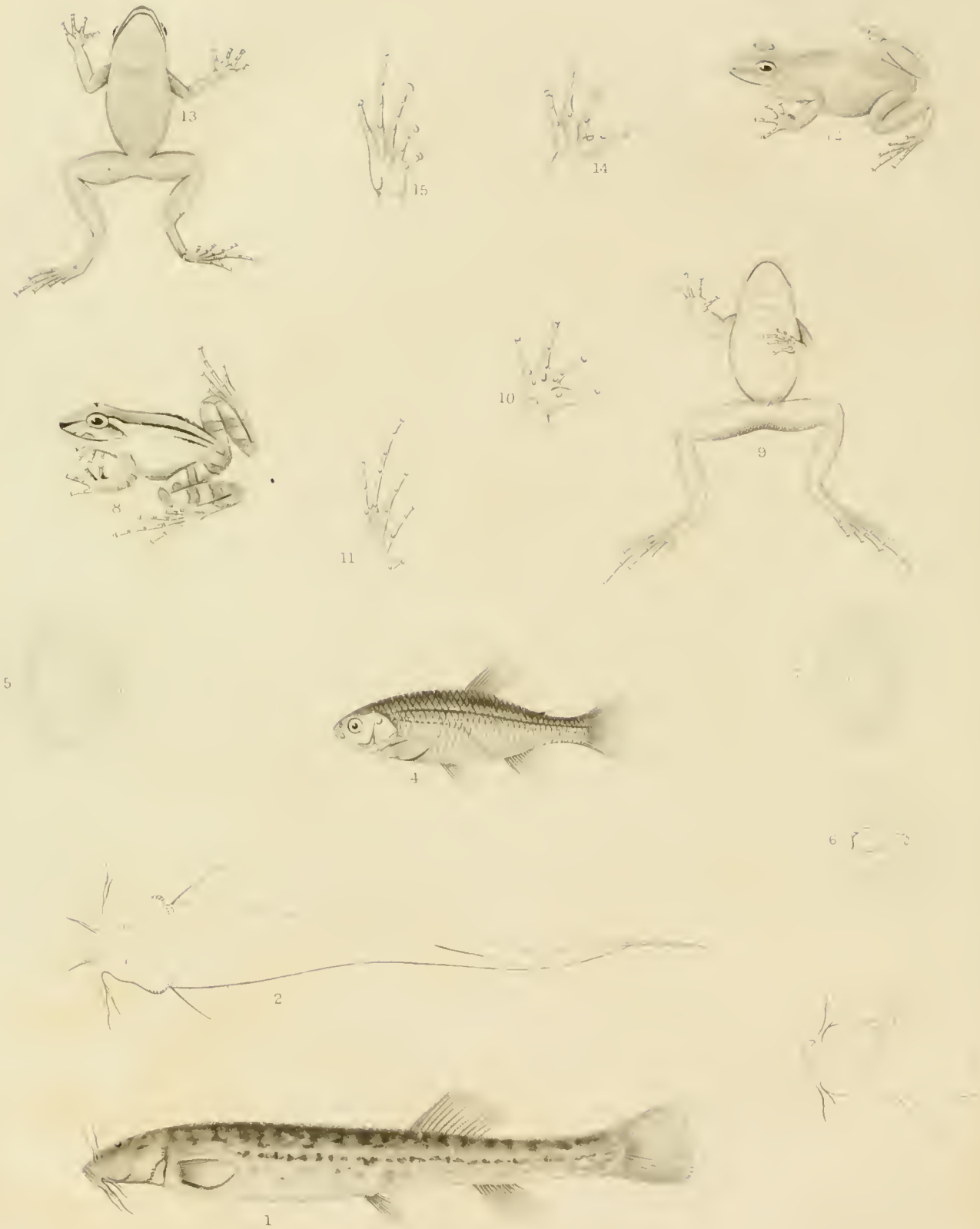
FAMILY OF HYLIDÆ.

Genus PHYLLOBATES, Dum. & B.

Gen. char. Snout protruding over the lower jaw; tongue free posteriorly upon a considerable portion of its length; no teeth on the palate; tympanum visible; tubes of eustachii small; fingers and toes slightly depressed, entirely free, dilated upon their extremity into a disk slightly convex below and above, the latter surface being provided upon its middle with a small groove. Protrusion of the first cuneiform bone very little developed; transverse apophysis of the sacral vertebræ not dilated.

Syn. *Phyllobates*, Dum. & B. Erp. Gén. VIII, 1841, 637.

Obs. The shape of the snout reminds us of *Elosia*, but the latter is provided with palatine teeth.



J. H. Richard

Figs. 1–3. TRICHOMYCTERUS MACULATUS, [illegible] Fig. 4. CHEIRODON [illegible]

Figs. 8–11. CYSTIGNATHUS TAENIATUS, Grd. Figs. 12–14. PHYLLOBATES AURATUS, [illegible]

PHYLLOBATES AURATUS, Girard.

PLATE XXXIV, Figs. 12—15.

SPEC. CHAR. Tongue narrow and elongated, free for about the half or two-thirds of its length; anterior limbs, when stretched backwards, reaching the vent with the tip of longest finger; inferior surface of thighs granular; color uniform bluish brown.

SYN. *Phyllobates auratus*, GRD. Proc. Acad. Nat. Sc. Philad. VII, 1854, 226.

DESCR. The body is elongated and depressed, as well as the head, which constitutes a little less than the third of the whole length; seen from above, the head is subtriangular, subtruncated anteriorly, and sloping inwardly. The nostrils are small, situated on the sides and towards the tip of the snout, and not to be seen from above; the sides of the head are declivous. The eyes are well developed, subelliptical in form, their horizontal diameter being equal to the distance between the anterior rim of the orbit and the tip of the snout, and comprised a little over twice upon the distance between the external margins of the upper eyelids. The tympanum is well developed, oblong in shape, and vertically situated close to the orbit. The angle of the mouth extends as far back as the posterior rim of the orbit. The tongue is narrow and elongated, posteriorly obtuse, and free for about the half or two-thirds of its length. The inner nares are very large and subcircular, situated far apart on the sides of the roof of the mouth, which is concave and perfectly smooth, there being no teeth on either the vomer or palatine bones. The openings for the tubes of eustachii are small, and not conspicuous. The anterior limbs are slender, the fingers stretching beyond the groin. The fingers are free, slender, depressed, and dilated upon their tips; upper surface of the dilation divided by a medial groove or furrow. There is a large metacarpal tubercle; smaller tubercles are observed under the first phalanx, and under the second of the two external fingers. The palm of the hand is smooth. The first finger is longer than the second; the fourth is the shortest, and the most slender of all. The hind limbs are stoutish, one-fourth longer than the body and head together—the tibia being more developed than the femur. The toes are free, slender, depressed and dilated upon their extremities, and grooved above in the same manner as the fingers. The sole of the foot is smooth, and the inferior surface of all the phalanges provided with very small tubercles. The internal metatarsal tubercle is elongated, the external one rounded; both of moderate development. The inferior surface of the thighs is granular; the skin is otherwise perfectly smooth; its surface, under the magnifying glass, exhibits very minute pores, scarcely more developed under the belly than on the back. The color above is metallic golden, whilst beneath a uniform bluish brown predominates.

Collected by the late Professor C. B. Adams, on the island of Taboga, in the bay of Panama.

Plate XXXIV, fig. 12, represents *Phyllobates auratus* in a profile view, size of life.
fig. 13, is a view from beneath.
fig. 15, a hand, seen from below.
fig. 15, a foot, also from below.

Figs. 14 and 15 are slightly magnified.

OPHIDIA.

FAMILY OF VIPERIDÆ.

Genus ELAPS, Schn.

GEN. CHAR. Body slender and cylindrical; tail short and conical; head somewhat depressed—in most cases continuous with the body, subelliptical when viewed from above, tapering for-

wards, and covered above with plates, generally nine in number; no pit between the eye and nostril; loral plate present; mouth moderately cleft, not dilatable; upper jaw furnished on either side and quite posteriorly with a poisonous fang; scales smooth; preanal scutella bifid; subcaudal scutellæ divided.

Syn. *Elaps*, Schn. Hist. Amph. Nat. and Lit. 1801, 289.
Fitz. N. Class. Rept. 1826, 33.
B. & G. Cat. Rept. N. Amer. I, 1853, 21.

Obs. The characteristic of the genus *Elaps*, as given above, we wish it to be understood, is merely provisional, not having had at our command a sufficient number of the species described by the different authors. We reserve it for another occasion to revise its diagnosis in a manner satisfactory both to our mind and to the actual state of herpetology.

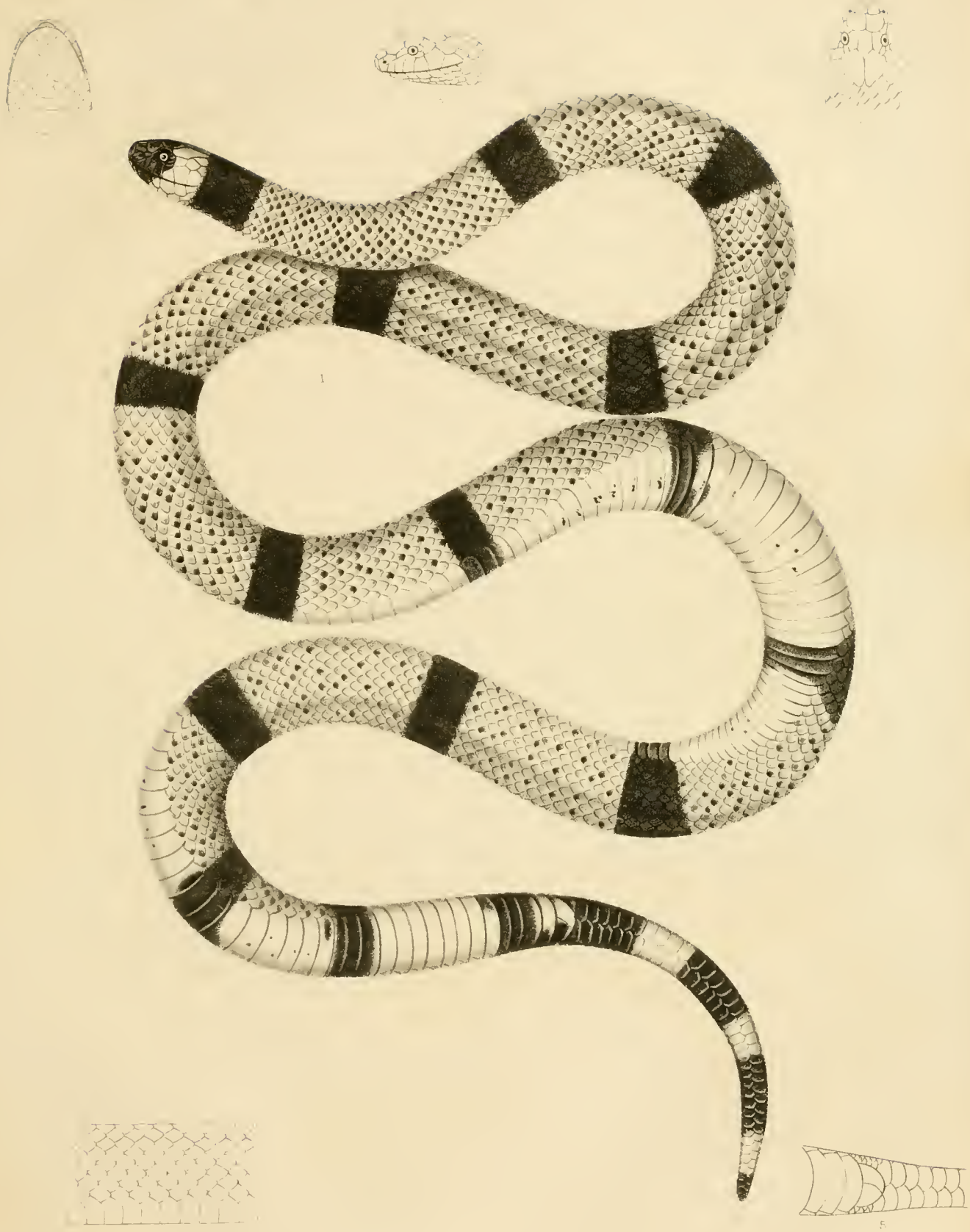
ELAPS NIGROCINCTUS, Girard.

Plate XXXV, Figs. 1—6.

Spec. char. Head subelliptical, broader than the body, which is long and cylindrical; tail conical, abruptly tapering from its base; scales smooth, disposed upon fifteen rows; color reddish, annulated with jet black; tip of scales blackish; anterior portion of head black; an occipito-temporal yellowish ring; tip of tail black.

Syn. *Elaps nigrocinctus*, Grd. Proc. Acad. Nat. Sc. Philad. VII, 1854, 226.

Descr. The head is slightly detached from the body by a somewhat contracted neck. The eyes are very small, situated near the upper surface of the head, their diameter being equal to the width of the suroculary plate. The snout is obtusely rounded. The vertical plate is moderately elongated and subpentagonal, pointed posteriorly; its anterior margin is sometimes perfectly straight, at others subconvex, so as to assume a subhexagonal shape. The occipitals are large, broad, and elongated, subrounded exteriorly, truncated anteriorly, permitting the posterior angle of the vertical to engage between them. The suroculary is short, a little longer than broad, and irregular in its outline, which is five-sided; the side limiting the orbit above being slightly concave, the others nearly straight. The postfrontals are well developed, broader than long, and irregularly six-sided, sending an angular projection towards the sides of the head, where it engages between the ante-orbital and postnasal plates, without, however, reaching the labials. The prefrontals are subquadrangular, broader than long, their external margin reaching the upper edge of the nostrils. The rostral is broadly developed, rather short, subpyramidal in form, and concave beneath. The nasals are well developed, the posterior one being nearly as long as the anterior is high. The nostrils are small and circular, intermediate between the two nasal plates. The anteorbital is irregularly triangular, rather elongated, and similar in shape to the postnasal, the anterior angle of which meets its own posterior angle a little in advance of the commissure between the second and third labials. The postorbitals, two in number, are nearly equal in size, and subpentagonal in shape. There are three temporal shields well developed, the posterior one being the largest. We observe seven upper labials, increasing in size from the first or anterior to the sixth inclusive; the seventh is a little smaller than the sixth; the third and fourth forming part of the orbit. There are six lower labials, of which the fourth is the largest, and much expanded beneath; the fifth is nearly equal to the third; the sixth is a little smaller than the latter; the second is the smallest. The symphyseal plate is triangular. The mental shields constitute three pairs; the anterior two being parallel to one another; the third is obliquely situated along the margin of the



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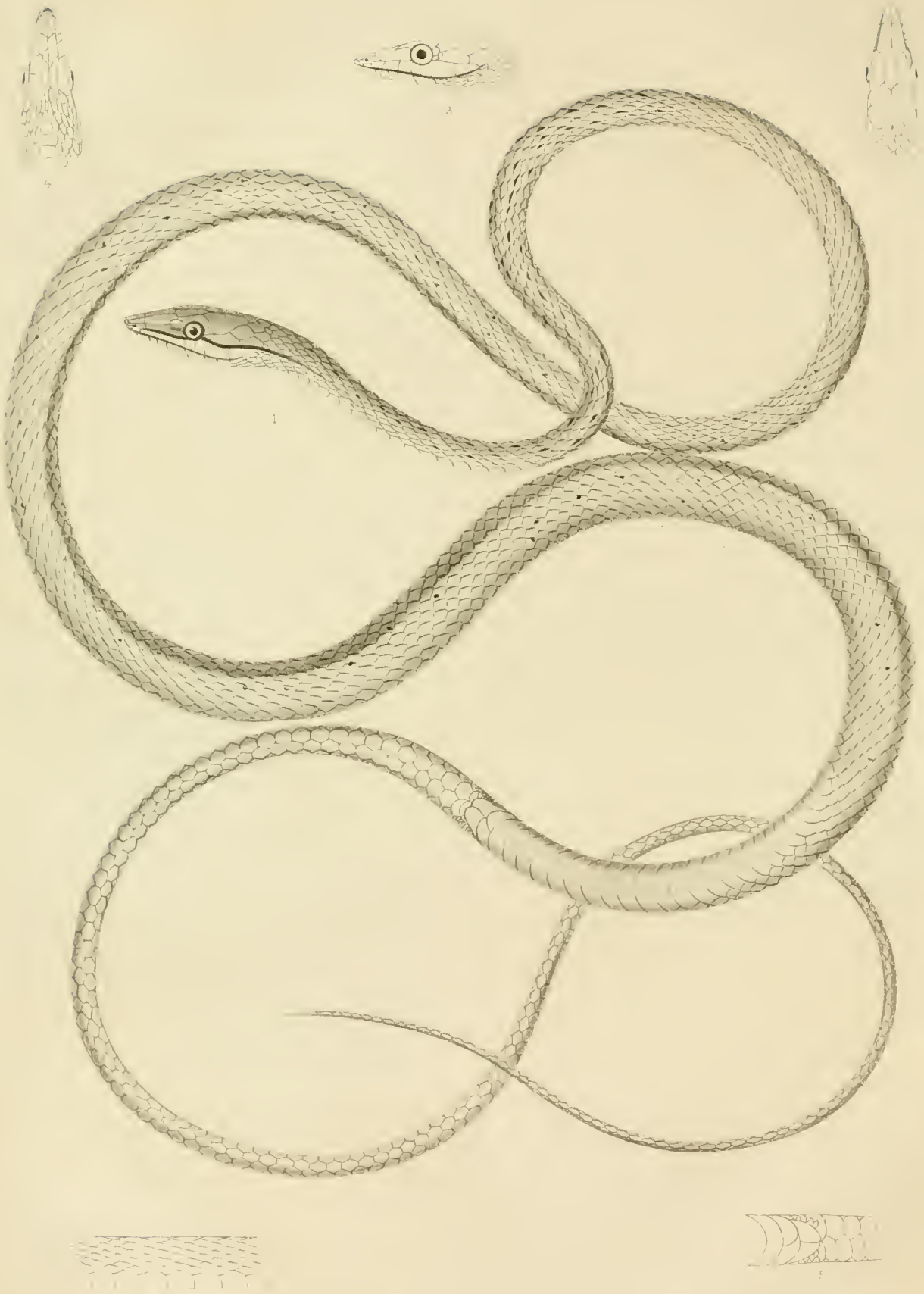
ELAPS NIGROCINCTUS, Gird.



J H Richard

fourth, fifth, and sixth lower labials. The body is subcylindrical, a little more slender anteriorly than posteriorly. The tail is short, subconical, and tapering to a point; it forms but the two-twenty-first part of the whole length. The scales are perfectly smooth, constituting fifteen longitudinal rows, larger in the outermost row, and smallest upon the dorsal line or middle row. The scales themselves are acuminated posteriorly. On the tail they are shorter, and truncated posteriorly, constituting seven rows upon its origin, and three only towards its tip. The abdominal scutellæ are two hundred and eighteen in number: the preanal is bifid. The subcaudal scutellæ are all bifid, and constitute thirty-six pairs. The tip of the tail is conical in the adult state, and somewhat acute in young specimens.

Abd. sc. 217 + 1. Subc. sc. 18. Dors. rows 15. Total length 29 inches; tail $2\frac{7}{10}$.

The body is reddish, annulated with jet black. The anterior part of the head from behind the eye is black, then follows a yellow ring, embracing in its width almost the whole length of the occipital plate, and just behind it the first black ring, embracing the posterior part of the head and neck, covering about six scales. There are fifteen more black rings hence to the tail, each covering about three scales. The intermediate red spaces embrace anteriorly fourteen scales, ten upon the middle region of the body, and eight towards the tail. There is an obsolete indication of a yellow margin to the anterior two black rings. The scales in the red spaces are tipped with black on the tail; the black rings are much wider than the red ones, there being three of each kind; the tip is black. The inferior surface is reddish-yellow sparsely spread over with small and irregular black spots.

Specimens of this species were collected at Taboga, on the bay of Panama, Central America.

Plate XXXV, fig. 1, represents *Elaps nigrocinctus*, of the size of life.
fig. 2, a view of the head, seen from above.
fig. 3, a side view of the head.
fig. 4, the head, seen from below.
fig. 5, shows the vent and the bifid preanal scutella.
fig. 6, is a portion of the left side of the body, showing the shape and number of rows of scales.

Figs. 2—5 are slightly magnified.

FAMILY OF OXYCEPHALIDÆ.

Genus DRYOPHIS, Fitz.

Gen. char. Body and tail long and slender. Cephalic plates normal. Eyes large. One anteorbital plate; several postorbitals. No loral. One nasal, with nostril in its middle. Rostral situated under the snout, which protrudes over the lower jaw. Several labials constituting the inferior rim of orbit. Dorsal scales smooth. The last two abdominal scutallæ bifid; subcaudals all bifid.

Syn. *Dryophis*, Fitz. N. Class. Rept. 1826, 29 and 60.

DRYOPHIS VITTATUS, Girard.

Plate XXXVI, Figs. 1—6.

Spec. char. Three postorbital plates, two of which constituting the posterior rim of the orbit; the third being placed behind them. Fifth, sixth, and seventh, or fourth, fifth, and sixth labials

constructing the inferior rim of the orbit. A black vitta along the upper margin of upper maxillary plates extending posteriorly along a portion of the neck.

Syn. *Dryophis vittatus*, Grd. Proc. Acad. Nat. Sc. Philad. VII, 1854, 226.

Descr. The entire length of the specimen figured is forty-seven inches, of which eleven belong to the tail. The head measures about one inch and an eighth. Its upper surface is flattened; the inferior one subconvex, and the sides perpendicular. The eye is large and circular, and its diameter is comprised about six times in the length of the head. The snout is tapering, the upper jaw protruding considerably over the lower. The rostral plate is rather small, subcrescentic, convex anteriorly, and depressed upon its middle surface. It is obliquely situated at the inferior surface of the snout, showing but a very narrow edge in a view from above (fig. 2). The prefrontals are twice as long as broad upon the middle of their length; they belong exclusively to the upper surface of the head. The postfrontals are much larger than the latter, one-third longer upon their upper surface, and extend upon the sides of the head until they reach the upper labials. The vertical is elongated and slender, subtruncated anteriorly, and subacute posteriorly, engaging between the inner margins of the occipitals. The latter are as long as the vertical, but broader anteriorly; their external margin being defined by an undulating line. The superciliaries are a little longer than the postfrontals, subtriangular in shape; the summit of the triangle directed forwards. There is a long and narrow nasal, in which, and rather in advance of the middle of its length, the nostril opens subangular in shape. There is no loral; but the lateral expansion of the postfrontals fills up the space between the nasal plate and a large anteorbital, much broader upwards than downwards, slightly visible in a view from above (fig. 2). Its anterior angle fits a notch in the posterior margin of the postfrontals, upon the line of demarcation between the sides and upper part of the head. The postorbitals are rather small, and three in number; two upon an anterior line, the lowermost being much the smallest of the two. A third, very small, is situated immediately behind the latter. Three large and subequal temporals terminate the series of cephalic plates and shields. The upper labials are nine in number; the posterior one being the longest and largest of all, and the anterior one the most slender. The fifth, sixth, and seventh constitute on the right side the inferior rim of the orbit, though the fifth and seventh only in part. On the left (fig. 3) there is one labial less. The lower labials are likewise nine in number; the fifth and sixth, situated beneath the eye, are the largest; the others diminishing gradually in size towards the anterior and posterior regions. The symphyseal or anterior odd lower labial is small, and rounded exteriorly. There are three pairs of elongated mental shields, the anterior pair reaching the margin of the jaw between the symphyseal and the first lower labial. The subgular scales are well developed and elongated.

The body is subcylindrical, much thinner anteriorly than posteriorly, the neck having about the thickness of the tail upon its anterior third. The scales are smooth, elongated, and acute posteriorly, constituting seventeen longitudinal rows upon the middle of the body, and twelve towards its posterior extremity. The external row, nearest to the abdominal scutellæ, is composed of the largest scales. The abdominal scutellæ, one hundred and ninety-five in number, are rather wide, convex upon their posterior margin; the posterior two are bifid. The tail is very slender, and tapering to a point; there are six rows of scales upon its anterior portion, near its origin; they are, moreover, broader and shorter than those on the body. The subcaudal scutellæ constitute a double row to nearly the tip of the tail, where scutellæ and scales assume a uniform aspect. One hundred and sixty-five pairs of the latter may distinctly be enumerated. Beyond that number verticiles of scales surround the remaining portion of the tail.

Abd. sc. 193 + 2. Subc. sc. 165. Dors. rows 17 and 12. Total length, 47 inches; tail, 18 inches.

The coloration must be much altered by the action of the alcoholic liquor in which the specimen

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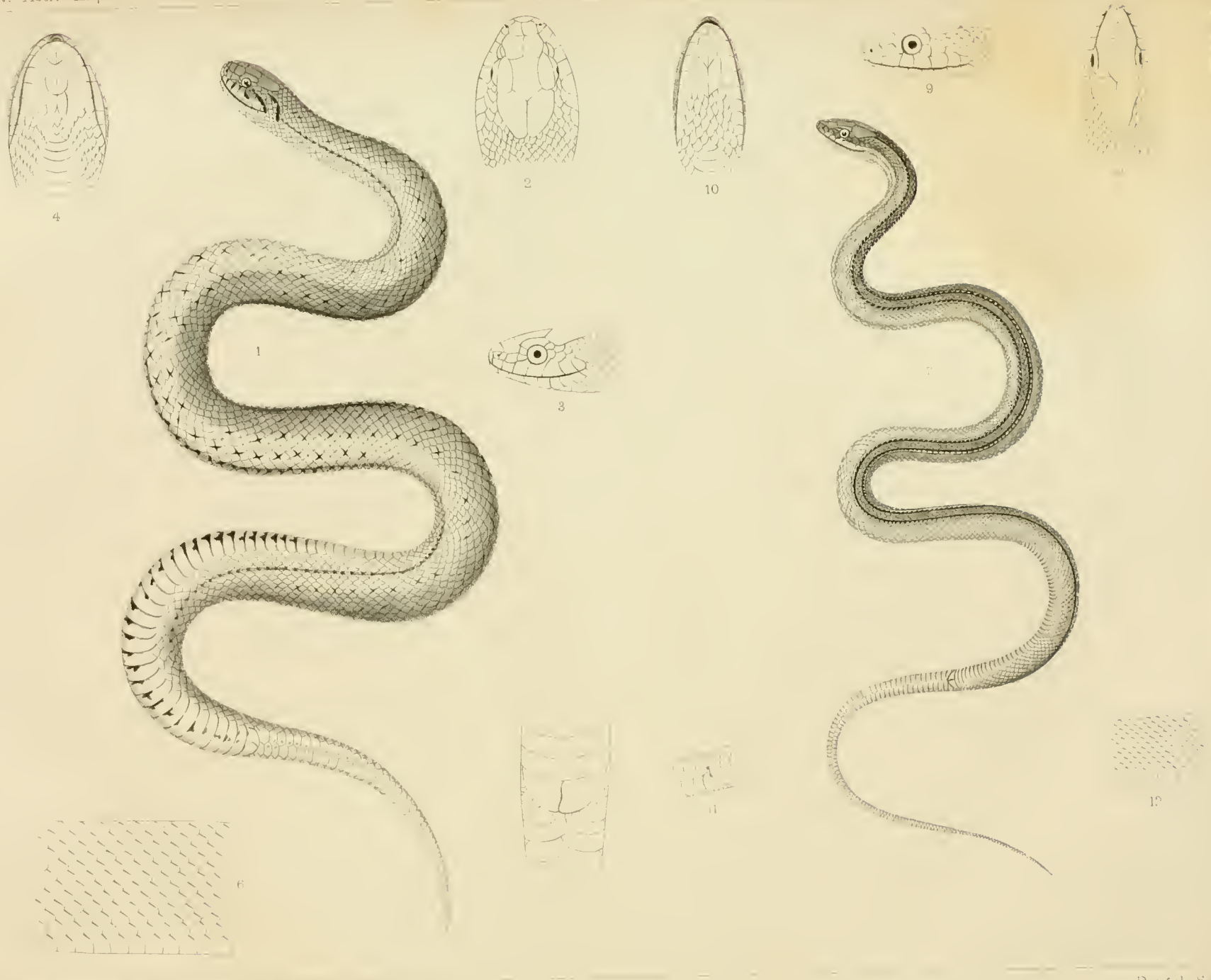

J.H.Richard

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TACHYMENES CHILENSIS, Grd.

TAENIOPHIS TANTILLUS, Grd.

is preserved. The upper surface and sides of heads are olivaceous brown, and the body and tail above purplish grey. Beneath and anteriorly the hue is of a soiled white, whilst posteriorly it is greyish yellow. The upper labials have the same hue as the lower surface of head. A black line may be traced along the upper margin of the upper labials, from the snout to about an inch and a half along the sides of the neck. Along the back and sides of the anterior part of the body there are oblique series of jet black elongated spots. The lower and inner margin of the scales is whitish, and apparent only when the skin is extended and the whole surface of the scales exposed. The posterior portion of the body is sparsely dotted with black; the tail is unicolor.

This species figured was collected on the island of Taboga, bay of Panama.

Plate XXXVI, fig. 1, represents *Dryophis vittatus*, of the size of life.
fig. 2, view of the head, seen from above.
fig. 3, side view of the head.
fig. 4, under view of the head.
fig. 5, vent and post-abdominal scutella.
fig. 6, a portion of the left side of the body, showing the form and number of longitudinal rows of scales.

FAMILY OF COLUBRIDÆ.

Genus TACHYMENIS, Wiegm.

Gen. char. Body subcylindrical, of moderate length; tail short, subconical, tapering. Head colubrine slightly detached from the body. Cephalic plates normal. Eyes of medium size. One or two anteorbitals and two postorbitals. One loral. Two nasals, with nostril between them. Jaws subequal. Dorsal scales smooth. Preanal scutella bifid. Subcaudal scutellæ all divided.

Syn. *Tachymenis*, Wiegm. in Nov. Act. Phys. Med. Acad. Nat. Cur. XVII. i. 1835, 251.

Obs. The genus *Tachymenis* is, so far, composed of two species, one from Peru figured and described by Wiegmann in the work cited above, and another from Chile, described below.

TACHYMENIS CHILENSIS, Girard.

Plate XXXVII, Figs. 1—6.

Spec. char. Two anteorbitals. Third and fourth labials constituting the inferior rim of the orbit. Dorsal scales in nineteen rows. Olivaceous brown above, with crossing lines of black. Beneath yellowish, with anterior margin of scutellæ black. Two postocular black vittæ.

Syn. *Coronella chilensis*, Schl. Ess. Phys. Serp. Part. descr. 1800, 30.
Guich. in *Gay*, Hist. de Chile, Zool. II, 1848, 79. Erpet. Plate iv, fig. 1, a, b, c, d.
Dipsas chilensis, Dum. Mém. Acad. des Sc. XXIII, 1853, 112.
Dum. & B. Erp. gén. VII. i, 1854, 608.
Tachymenis chilensis, Grd. Proc. Acad. Nat. Sc. Philad. VII, 1854, 226.

Gen. rem. Of the three specimens that were collected, the one which is figured is the largest, and yet not fully grown. Though immature, we propose to describe them carefully, since the figure in the Historia de Chile is not as accurate as might be desired. We have seen upon specimens of others species, the zoological characters entirely developed when they bore the same relations towards their adult as those now before us.

Descr. The head is subovoid, being depressed upon its upper surface; the snout is rounded, and the eye, subcircular in shape, is of moderate development, its diameter being equal to the width of the vertical plate upon the middle of its length. The vertical plate is large and subpentagonal, either slightly concave upon its sides or linear; its posterior extremity being moderately angular. The occipitals are a little shorter than the vertical, but anteriorly nearly as broad. The postfrontals are broader than long, extending but little to the sides of the head, being posteriorly rounded. The prefrontals are subtriangular, irregularly rounded off, and do not reach the nostrils. The rostral is subconical, concave beneath. The nostrils are small and subelliptical, situated between two plates the sutures of which are sometimes obliterated either above or below these apertures. The loral is quadrangular and larger than either the post or prenasals, which have the same general shape. There are two anteorbitals; the uppermost is longer than high, and a little longer than the lower one, which is rather narrow and elongated; also two postorbitals nearly equal in size and similar in shape. The temporal shields, seven or eight in number, are so small and so much like the scales, that there are only two that may readily be distinguished from the latter by their shape. The upper labials are seven in number: the fifth being the largest, the sixth is the next in size, then the fourth, the third, and the second; the seventh is a little larger than the first, which is the smallest of all. The third and fourth constitute the inferior rim of the orbit; their suture being situated beneath the pupil. The symphyseal is triangular; the lower labials, being nine in number, diminish in size both forwards and backwards from the fifth, which is the largest of all; the seventh, eighth, and ninth are rather narrow and elongated, whilst the four anterior are higher than long. The first one in particular is nearly twice the height of the second, and separates entirely the symphyseal from the anterior mental shields, of which it assumes the general feature. There are two pairs of mental shields of about the same length, but the posterior pair is more slender and posteriorly subacute.

The body is subcylindrical, thickest upon its middle, tapering both posteriorly and anteriorly where a somewhat contracted neck separates it from the head. The tail is subconical, pointed posteriorly, rather short, constituting about the sixth part of the entire length. The scales are smooth, disposed upon nineteen longitudinal series; they are subacute posteriorly, and largest upon the external series, gradually diminishing hence to the central or dorsal series. On the nape and under the head they are the smallest. The abdominal region is rather narrow. There are one hundred and fifty-five abdominal scutellæ, the posterior one being bifid, and forty-three subcaudal scutellæ, all of which bifid.

Abd. sc. 154 + 1. Subc. sc. 43. Dors. rows 19. Total length 15 inches and $\frac{3}{10}$; tail $2\frac{1}{2}$ inches.

The ground-color appears now olivaceous brown above, yellowish beneath. The anterior margin of the abdominal scutellæ being jet black with a subtriangular blotch upon their middle region, and occasionally also upon their extremities, the lower surface of the body may assume quite a maculated appearance. The anterior margin of all the scales is black, but when in their normal and imbricated state, the black is not seen externally except upon the fourth and eight series on either side, thus constituting two pair of obsolete vittæ. The middle dorsal series exhibits likewise the black margin of its scales, though in a less conspicuous manner as the specimens grow to a larger size. In the very immature condition almost every scale shows its black edge, constituting irregular zigzag lines. The dorsal vittæ sometimes assume the appearance of a series of double crescents contiguous upon their convexity: this is owing to the fact of the black extending along the sides of the scales. The lateral vittæ, from the neck ascend to the occipital region of the head, the sides of which are marked by two narrow black stripes, the upper one slightly arched, extending from the posterior rim of the orbit to the angle of the mouth; the other runs obliquely from the lower rim of the orbit, across the fourth and fifth labials to the edge of the mouth.

This species was collected in the vicinity of Santiago, Chile.

Plate XXXVI, fig. 1, represents *Tachymenis chilensis*, size of life.
fig. 2, the head viewed from above.
fig. 3, a side view of same.
fig. 4, a view of its inferior surface.
fig. 5, exhibits the vent and post-abdominal scutella.
fig. 6, is a portion of the left side showing the form of the scales and the number of their series.
Figs. 2—5 are slightly magnified.

Genus TAENIOPHIS, Girard.

Gen. char. Head depressed and detached from the body, which is slender and subcylindrical. Tail tapering to a point, and comparatively short. Cephalic plates normal. One anteorbital, and two postorbitals. An elongated, quadrangular loral. Two nasals, nostril between them. Eyes above the medium size, situated above the fourth and fifth labials; pupil circular. Mouth deeply cleft. Scales smooth, disposed upon nineteen longitudinal series. Post-abdominal scutella bifid; subcaudal scutellæ all divided. Colors disposed upon uniform longitudinal bands.

Syn. *Taeniophis*, Grd. Proc. Acad. Nat. Sc. Philad. VII, 1854, 226.

Obs. This genus is closely related to *Diadophis*, and may be distinguished from it by the presence of one anteorbital plate only, a larger number of longitudinal rows of scales, and the distribution of its colors.

It includes, so far, two species, both of which are new to science. One, an inhabitant of Chile, is described below; the other (*T. imperialis*, B. & G.) is Mexican: a specimen in the Smithsonian museum having been found at Matamoras.

TAENIOPHIS TANTILLUS, Girard.

Plate XXXVII, Figs. 7—12.

Spec. char. Body and tail very slender. Head elongated, and very distinct from the body. Eyes proportionally large. A deep chestnut-brown band along the dorsal region; light brown on the sides. Beneath greenish or yellowish grey. Upper labials yellowish-white. A superciliary yellowish filet.

Syn. *Taeniophis tantillus*, Grd. Proc. Acad. Nat. Sc. Philad. VII, 1854, 227.

Descr. The body is small, slender, and elongated; the tail conical and tapering, forming about the two sevenths of the total length. The head is small, well detached from the body by a contracted neck, depressed above, and declive upon the region anterior to the eye. The snout is obtuse. The eye is very large, and subcircular; its horizontal diameter being comprised once and a half across the ocular region of the head, embracing the vertical and superciliary plates; the pupil is circular. The nostrils are quite small, subcircular in shape, and situated between two nasal plates, though encroaching more upon the prenasal than upon the postnasal, which is slightly the largest of the two. The vertical plate is large, broadest anteriorly, rounded or subconvex upon its margin, subconcave upon the sides, and triangularly acute posteriorly. The occipital plates are larger than the vertical, and are externally rounded. The postfrontals are irregularly five-sided, and extend slightly to the sides of the head. The prefrontals are subtriangular, externally rounded. The rostral is broad but rather low, convex

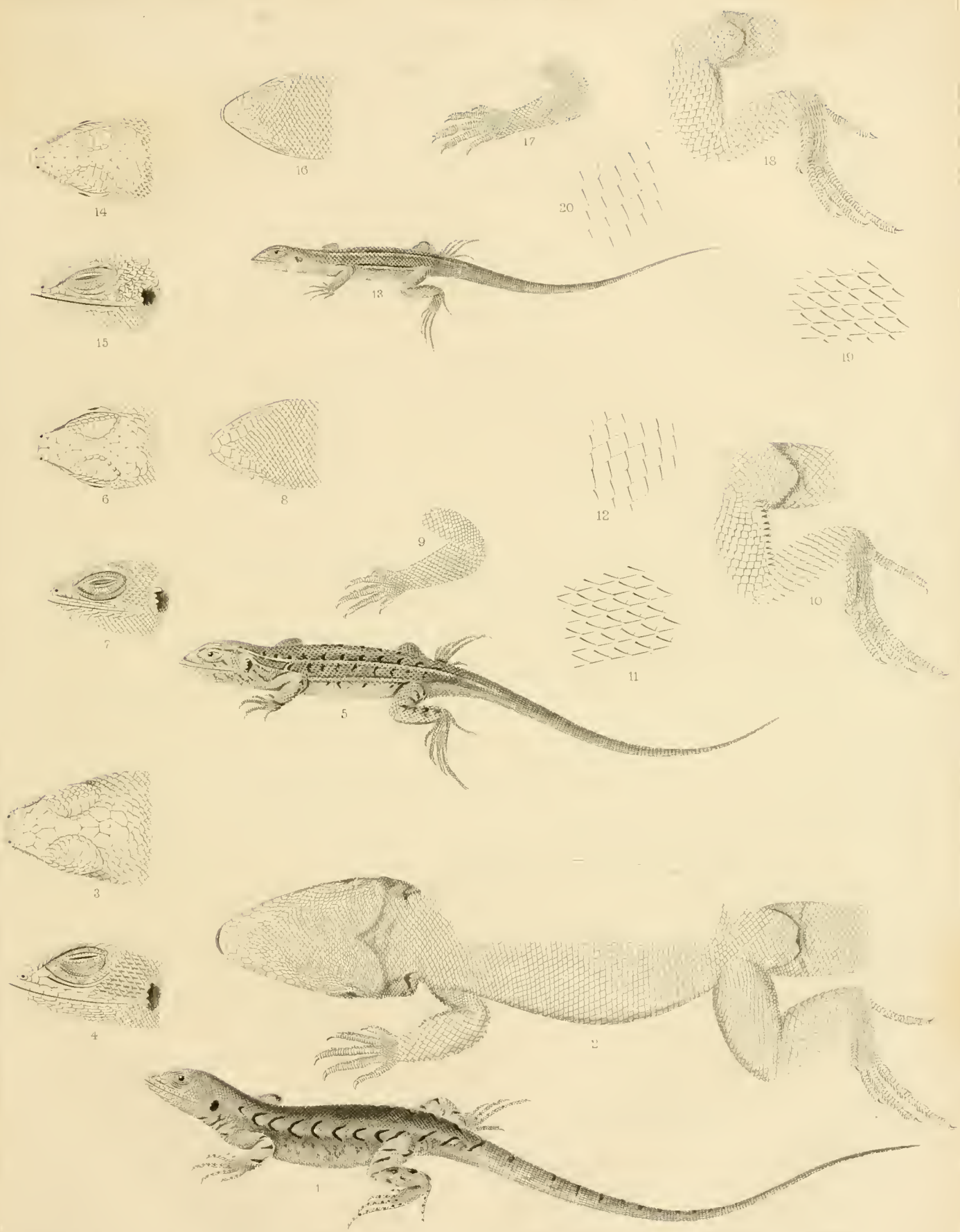
upon its upper margin, and very concave below. The postnasal is slightly larger than the prenasal. The loral is elongated and subtrapezoid. There is but one anteorbital, very narrow upon its lower portion, quite broad across the superciliary line, and extending to the upper surface of the head under the shape of a small triangle, the summit of which being contiguous to the lateral anterior edge of the vertical, thus preventing a contact between the postfrontals and the superciliaries. The latter are well developed, narrowest anteriorly. There are two postorbitals, the uppermost being twice the size of the lower. Two temporal shields only can be distinguished by their form from the occipital scales. The upper labials are eight in number, the fourth and fifth forming the inferior rim of the orbit; the fifth, sixth, and seventh are the largest; the fourth is a little larger than the eighth, the anterior three being the smallest. There are ten inferior labials, and a symphyseal, quite small and triangular. The first extends to the anterior pair of mental shields; the second and third are the smallest of the three; the fourth, seventh, eighth, ninth, and tenth are nearly equal; the sixth is the largest, and the fifth somewhat smaller than the sixth. The posterior pair of mental shields is more slender than the anterior pair, but nearly of the same length. The abdominal scutellæ are a hundred and ninety-five in number; the posterior is bifid. There are about a hundred and ten subcaudal scutellæ, all of which are subdivided. The scales are elongated and posteriorly subacute, smooth and disposed upon nineteen longitudinal series, the two outermost of which being the largest; the others diminishing slightly towards the dorsal region.

Abd. sc. 194+1. Subc. sc. 110. Dors. rows 19. Total length, 12 inches; tail, 3 inches and $\frac{3}{10}$.

The ground-color of the sides of the body is light brown, minutely dotted with black. On the back there is a band of deep chestnut-brown margined with black, covering three longitudinal rows of scales. The two adjoining rows are partly (internally) brown and partly (externally) black. Along the neck and anterior fourth of the body each scale of the external series, covered by the dark dorsal band, has a white spot upon its middle, thus interrupting the black border. Towards the posterior part of the body the dorsal brown band covers but three series of scales, the internal margin of the adjoining series being black. Along the tail, where that band may be traced tapering towards its top, the black margin has immerged into the brown. The inferior surface of the body is uniform greenish or yellowish grey. The upper surface of the head is dark brown. A yellowish white filet or stripe extends from the rostral plate, along the superciliary ridge, to the posterior extremity of the superciliary plates. A subelliptical spot of the same hue, but margined with black, may be seen on the upper part of the upper postorbital plate, interrupting the vitta just alluded to, and which can be traced along the external edge of the occipital plate, more conspicuous, and margined with black. The vitta extends along the neck, and eventually immerges into the dorsal band. The sides of the head are brown, and of a deeper hue than the sides of the body; the upper labial plates being also yellowish-white. A vitta of that same hue may be traced from near the top of the jaw along the neck. The inferior labials, the mental shields, and the subgular scales, exhibit each a central light spot margined with black. Two light vittæ may be followed, one on the two external rows of scales, another along the edge of the abdominal scutellæ, from beneath the throat to a considerable length backwards. The hue of the sides of the head likewise tapers along the sides of the neck for about the same distance.

Specimens of this species were obtained from the vicinity of Santiago, Chile.

Plate XXXVII, fig. 7, represents *Taeniophis tantillus*, size of life.
fig. 8, is the head, seen from above.
fig. 9, a side view of the head.
fig. 10, the head, seen from below.
fig. 11, exhibits the vent and post-abdominal scutella.
fig. 12, a portion of the left side of the body, showing the shape of the scales, their relative size, and disposition in series.



J.H.Richard Dougal Sc.

Figs 1–4 PROCTOTRETUS TENUIS, Dum & Bibr. Figs 5–12. PROCTOTRETUS FEMORATUS, Grd.
Figs 13–20. PROCTOTRETUS STANTONI, Grd

SAURIA.

FAMILY OF STELLIONIDÆ.

Genus PROCTOTRETUS, Dum. & B.

Gen. char. Body rounded or slightly depressed, covered with imbricated scales; the upper ones carinated, the inferior ones generally smooth; neither a dorsal nor a caudal crest; head subpyramido-quadrangular, more or less depressed; cephalic plates moderate, polygonal; occipital generally not very conspicuous; teeth on the palate; sides of neck either folded or smooth; no subgular fold; an ear opening; membrane of tympanum but little depressed; fingers simple; tail either long or conical, or moderate and slightly depressed; no femoral pores; anal pores in the males.

Syn. *Proctotretus*, Dum. & B. Erp. gén. IV, 1837, 266.
Guich. in Gay, Hist. de Chile, Zool. II, 1848, 23.

PROCTOTRETUS TENUIS, Dum. and B.

Plate XL, Figs. 1—4.

Spec. char. Cephalic plates usually smooth, occasionally covered with very minute granules. Auricular aperture large; its anterior margin subtubercular. One series of supralabials. Temporal plates irregularly rounded, subimbricated, subtuberculous, and of moderate development. Sides of neck folded and granular. Dorsal scales small, carinated, and posteriorly obtuse; lateral scales smaller, not imbricated, provided with a rudimentary carina; abdominal scutellæ smooth and mostly entire. Posterior surface of thighs minutely granular. Tail long and slender. Brownish-black, with transverse subcrescentic black bands.

Syn. *Proctotretus tenuis*, Dum. & B. Erp. gén. IV, 1837, 279.
Bell, Zool. of the Beagle, V, Rept. 1843, 7, Plate iii, fig. 2.
Guich. in Gay, Hist. Chile, II, 1848, 32, Erp. Plate i, fig. 1.
Hombr. and Jacq. Voy. au Pole Sud et dans l'Océanie, Plate ii, fig. 2.

Descr. The form, although slender in its general aspect, is less a characteristic of this species than it really is for several others of its congenere. The body is depressed; swollen upon its middle region; the limbs being of moderate development. The anterior, when stretched alongside the body, are far from attaining the groins; and the tip of the longest toe of the posterior, when the latter are brought forwards, reaches the middle region of the neck. The tail is elongated, conical, tapering to a point, and nearly twice as long as the body and head together.

The tongue is large and fleshy; elongated in shape and depressed, sublanceolated, occupying the entire space between the two branches of the lower jaw. The teeth are of moderate development, smallest anteriorly, and subcylindrical; whilst posteriorly these are somewhat flattened, or else stouter upon their base.

The head is depressed, subtriangular in a view from above, and rounded upon the snout. The plates which cover its surface are generally smooth, but exhibit sometimes a very minute granulation, apparent only through a magnifying glass. The cephalic plates vary as regards both their size and number, being smallest when most numerous. In the specimen figured, there are three pairs of frontals: one pair of post-occipitals, an odd occipital, a vertical, and an odd frontal, which are somewhat larger than the rest, and nearly equal among themselves. An inner series of surocularies may be noticed as the next in size; they are separated from

the vertical or interocular, and the occipitals, by a concentric series of small plates. There is but one and a rather small nasal, in the midst of which the nostril opens, leaving but a narrow rim. The loral region is occupied by several small plates. The anterior suborbitals are more developed than the posterior, all of which being provided with a keel along their inner margin. The superciliary ridge is composed of about six elongated, narrow, and obliquely superposed plates. The lids are covered with very small plates, the marginal series being somewhat more developed than the rest, except on the periphery of these organs, and yet may still be distinguished from the latter by their regular shape and disposition. The rostral is transversally elongated and very low. The upper labials are very elongated and very narrow, six or seven in number, increasing in length from the first to the fourth inclusive, then diminish considerably backwards. The supralabials have the same general appearance as the labials themselves, save in being a little smaller. Occasionally two or more minute plates may be observed upon the loral region between the loral plates proper and the supralabials. The temporal plates are of moderate development, and of nearly equal size with the post-occipitals. They are irregularly rounded, slightly imbricated, and provided either with a rudimentary tubercle or an obsolete carina. The symphyseal is larger than the rostral, and especially broader upon its middle region. The inferior labials (five or six in number) are broader than the upper, more conspicuous therefore, and diminishing gradually backwards. There are four or five pairs of mental shields: the anterior pair being the largest and contiguous upon their inner margin, whilst the other pairs diverge, and gradually diminish in size backwards. Between the mental shields and lower labial plates there exists a complete series, and part of a second, of small infralabials. The inferior surface of the head, the throat, the belly, the preanal region, thighs, and legs, are covered with smooth, posteriorly obtuse, and generally entire scales or scutellæ of moderate development, a little smaller under the head and larger under the hind limbs; some few on the sides of the belly exhibiting a small notch posteriorly. The sides of the neck, the insertion of the limbs, the inferior surface of the forearm, and the posterior surface of the thighs, are granular. On the sides of the abdomen the scales are irregularly rounded, subtuberculous, or subcarinated, and smaller than those on the dorsal region, which are distinctly, though moderately, carinated, and posteriorly obtuse. The upper surface of the limbs and the inferior surface of the arm are covered with scales similar in shape and structure to those on the back; on the palm of the hands and the sole of the feet they are much smaller, acute posteriorly, and distinctly carinated; around the fingers and toes they constitute irregular verticiles—the superior ones being more irregular in size than the inferior, and less distinctly carinated. The inner or first finger is the smallest; the outermost is the next in length; then the second; then the third, which is nearly as long as the fourth, which is the longest. The nails are rather short, compressed, acerated upon their extremity, and gently curved. The first toe is the smallest; the second is the next in length; then the fifth; then the third; the fourth is the longest. Their nails do not differ materially from those of the fingers. The scales which cover the tail are the most conspicuous of all; they constitute oblique series upon the base of that organ, and annular rows further backwards. The oblique series have the same shape as those of the back. Those constituting the annular rows are superiorly subquadrangular and elongated, with their carina oblique; whilst beneath, they become much narrower, posteriorly acute, with a straight carina along their middle region.

The ground-color is blackish brown in the male, and greenish brown in the female; in either sex there are two parallel series of transverse black bands, convex anteriorly, margined with a whitish, or else a lighter tint along their concavity. These bands, however, are more conspicuous in the female than in the male. They may be traced from the head, on each side of the dorsal region, to the posterior extremity of the body, where the series, from either side, combine more or less into one, which extends along the upper surface of the tail. The limbs, as well as the tail, are transversally barred with black. In the female, the dorsal region and the flanks are either dotted with black or spotted with whitish; whilst in the male, these spots

are either bluish, reddish, or else of a metallic green, especially on the neck. The upper surface and sides of the head are spotted with different shades of black, or dotted with yellow and black. The occipital region and the back, in the male, occasionally exhibit sinuating black lines upon a brownish ground, which itself bears bluish, greenish, or slate-colored spots. Beneath, the ground-color is whitish, vermiculated, maculated or clouded with greyish lines, spots, or dots. That region sometimes is unicolor in the female.

This species appears to be quite abundant in the vicinity of Santiago, Chile, whence numerous specimens were obtained and preserved.

Plate XXXVIII, fig. 1, represents a profile view of the female sex of *Proctotretus tenuis*, size of life.

fig. 2, is an under view, showing the structure of that region.

fig. 3, is an upper view of the head.

fig. 4, a side view of the head.

Figs. 2, 3, and 4, are slightly magnified.

PROCTOTRETUS FEMORATUS, Girard.

Plate XL, Figs. 5—12.

Spec. char. Cephalic plates rugose. Auricular aperture moderate, provided with an arched plate upon its supero-anterior margin, and one or two conical scales beneath and upon the same anterior margin. One series of supralabials. Temporal shields well developed, imbricated and carinated. Sides of neck with but one inconspicuous fold, and covered with small carinated scales. Dorsal scales large, carinated, posteriorly acute, and diminishing in size towards the sides. Abdominal scutellæ smooth and entire. Posterior surface of thighs granular. Tail elongated and slender. Brownish, with two parallel light vittæ on either side, and two series of black spots. Abdomen whitish, unicolor; inferior surface of head with greyish, irregularly broken lines.

Syn. *Proctotretus femoratus*, Grd. Proc. Acad. Nat. Sc. Philad. VII, 1854, 227.

Descr. This species has the same slender aspect as *P. tenuis*, the limbs and tail being developed nearly in the same proportions. The body, mayhap, is a little shorter, and more slender still. The tongue and teeth present the same general shape and structure. The head is depressed, and quite declive from the frontal region towards the snout. Viewed from above, it is subtriangular, subtruncated anteriorly. The cephalic plates are of moderate development; exhibiting upon their surface sinuating, subtubercular ridges, which give to that region a rugose appearance. The vertical, a pair of post-occipitals, and two pairs of postfrontals may be distinguished, amid their number, as the largest. Three postinternal superciliaries hold the same relations towards their analogues as the former; a concentric chain being observed upon the inner margin of the surface of the upper lid. The perforation of the nostrils takes place through one single plate more towards its posterior or inferior edge than the anterior. The loral region being considerably reduced by the declivity of the frontal region, there are but one or two loral plates. The suborbital chain is composed of three narrow and elongated plates, provided internally with a conspicuous and sharp ridge or crest; the longest occupying the inferior rim of the orbit and the other two its anterior rim; whilst the posterior rim is formed by the anterior temporal plates. The superciliary ridge is composed of five or six obliquely superposed plates, smallest posteriorly. The surface of the lids is granular; their margins being provided with a series of very small plates. The rostral is transversally elongated and

very low. The upper labials are elongated and narrow, six in number, increasing in size from the first to the fourth, which is the longest, then diminishing again posteriorly. The supralabial series is composed of about an equal number of similar plates but narrower still. The symphyseal is larger than the rostral, and especially broader upon its middle region. The inferior labials, six or seven in number, are broader than the upper, diminishing gradually backwards. There are four pairs of mental shields: the anterior pair is the largest, contiguous upon the inner margins, whilst the other pairs diverge in diminishing in size posteriorly. A series of infra-labials may be traced from the angle of the mouth to between a portion of the first inferior labial plate and anterior mental shield. The temporal plates are well developed, particularly towards the upper region; they are posteriorly obtuse, imbricated, and distinctly carinated. The side of the neck, which exhibits a very obsolete fold, is covered with small, acute, and carinated scales. The posterior margin of the auricular aperture and region of the shoulder are minutely granular. The dorsal scales are rather large upon the back, diminishing in size towards the middle of the flank, being carinated and acute posteriorly. The inferior half of the flanks are covered with scales or scutellæ similar to those which exist upon the belly, being only a little smaller and obsoletely carinated upwards. The abdominal scutellæ or scales are smooth, obtuse posteriorly, and rather smaller than the dorsal scales. Under the head and throat they do not differ materially from those on the abdomen, but are a little larger under the head than under the throat: their posterior margin is entire. If an obsolete notch is to be observed at all, it is in those occupying the flanks, but that notch may be owing to the fact that the carinæ do not always extend to the posterior margin. The upper surface of the anterior limbs is covered with scales similar to, but smaller than those on the back, obtuse and smooth upon the anterior region and the carpus. Under the forearm they are very small and smooth, increasing in size under the arm, and again diminishing towards the palm of the hand, which is entirely covered with them, and not only carinated and posteriorly acerated, but provided also with a lateral acute processus, particularly developed upon the metacarpal region. The fingers above are plated and smooth; beneath they are provided with small scales, carinated, acerated posteriorly and disposed upon regular transverse rows. The fingers have the same relative length, and the nails the same form as in *P. tenuis*. The hind limbs and the tarsi are covered above with scales similar, but smaller than those on the back, and larger than on the fore limbs, carinated even on the tarsi. The anterior tibio-metatarsal region is distinguished by very small scales, almost passing to the granular aspect. The posterior surface of the thighs is granular; whilst their inferior surface is covered anteriorly with scutellæ similar to those of the abdomen, and posteriorly with three or four series of scales, somewhat acute and projecting beyond the surface of that organ, the external series being the most developed. On the inferior surface of the femoral region the scutellæ or scales are subcarinated and well developed, the external series projecting a little beyond the surface of the organ. On the sole of the feet the scales are quite small, acute, and more distinctly carinated. The toes are surrounded with small subverticillated scales, more uniform and more distinctly carinated beneath than above. The proportional length of the toes and the form of the nails is the same as in *P. tenuis*. The candal scales have likewise the same general structure; there being, however, no contrast in size between them and those of the back, though a little larger on the base of that organ. The ground-color is brown, olivaceous, or blackish. The upper surface of the head is either unicolor or dotted with blackish; its sides generally exhibit two or three oblique and black lines extending from beneath the orbit towards either the margin or the angle of the mouth. The suborbital ridge may be black also. There are two parallel light vittæ on the sides of the body, the uppermost extending from the surciliary ridge to a portion of the tail; the lower one extends from the temporal region across the upper edge of the auricular aperture, and above the insertion of fore limbs to the groin. The dorsal region sometimes is lighter than the sides, and appears like another broad vitta. There are two series of black, transversally elongated spots, with a light or bluish margin; the intermediate space

being dark brown. The first series stretches immediately along the inner margin of the upper vitta; the second is enclosed between the two vittæ. The lower half of the flanks, beneath the inferior vitta, is covered with irregularly vertical or rounded black spots. The inferior surface of the body is unicolor whitish or greyish; numerous interrupted series of linear spots are observed under the head and inferior portion of its sides. The vittæ upon the latter regions are margined with black. There is an irregular black spot at the shoulder close to the insertion of the fore limbs. The series of dorsal spots extends along the upper surface and sides of the tail; the latter is maculated with greyish below. The limbs above are transversally barred, and beneath they are of the same hue as the abdomen.

In some, probably male specimens, the vittæ and spots are less distinct, and immerge into the ground-color. The sides of the abdomen are of a reddish metallic hue, with black and bluish small spots.

Specimens of this species were collected in the vicinity of Santiago, Chile.

Plate XXXVIII, fig. 5, represents the profile of *Proctotretus femoratus*, size of life.
fig. 6, is the head, seen from above.
fig. 7, a side view of the head.
fig. 8, the head, from below.
fig. 9, shows the inferior surface of the anterior limb.
fig. 10, the inferior surface of the posterior limb and the vent also.
fig. 11, some dorsal scales.
fig. 12, some abdominal scutellæ.

Figs. 6—12 are slightly magnified, in order to show readily the structures they are intended to represent.

PROCTOTRETUS STANTONI, Girard.

Plate XL, Figs. 13—20.

Spec. char. Cephalic plates rugose. Auricular aperture moderate, margined anteriorly with very small scales, one of which is larger than the rest. One series of supralabials. Temporal shields well developed, subrounded, imbricated, and carinated. Sides of neck with one indistinct fold, and covered with acute and carinated scales, a little smaller than those of the back, which are large, posteriorly subacute, and strongly carinated. Abdominal scutellæ rounded posteriorly and slightly carinated. Posterior surface of thighs granular. Tail elongated and slender. Ground-color deep brown, with a reddish tint posteriorly; two parallel vittæ on the sides. Abdomen unicolor, with metallic reflections.

Syn. *Proctotretus stantoni*, Grd. Proc. Acad. Nat. Sc. Philad. VII, 1854, 227.

Descr. The specimen figured—the only one in our possession—is of a rather small size, and, in all likelihood, not fully grown. It resembles, in general appearance, *P. gracilis*, particularly in its system of coloration, differing, however, in too many peculiarities of structure to dwell at all upon that external resemblance.

The head is very depressed and sloping upon the frontal distance. Seen from above, its shape is subovoid, rather narrow anteriorly. The cephalic plates, the surface of which is slightly rugose, are well developed, and the frontals symmetrically arranged; thus we find two pairs of small prefrontals and three pairs of considerably larger postfrontals, separated by a transverse series of three plates, the middle one of which is much larger than the adjoining two, though itself equal to the smallest postfrontals. There is a vertical of medium size, a

small, odd occipital, on each side of which, and immediately in advance of a large pair of post-occipitals, is seen a pair of small plates. Two more pairs, equal in size to the last, may be observed on either side of the large post-occipitals, and finally, behind the latter a series or two of quite small plates, limiting the occipital region. The nostrils open in one single plate; there are three lorals, one forming the continuation of the superciliary ridge, above which and the nasal, between these and the frontals, there are four minute, elongated plates irregularly disposed. The superciliary ridge is composed of six obliquely superposed laminæ. The superoculars are nearly as large as the prefrontals, and surrounded by a series of small plates. The suborbital series consists of two plates only, a very long one beneath the orbit, and another rather small anteriorly, their inner crest or ridge being well marked. The posterior rim of the orbit is margined by small plates alike the temporal group. The surface of the lids is minutely granular; their margin is provided with a double series of very narrow, elongated, and very small plates. The rostral is transversally elongated, but quite low, or else narrow. The upper labials, five in number, are very narrow and elongated, increasing in length from the first to the fourth inclusive; the fifth is equal to the first. The supralabials are very exiguous; the middle ones being the longest. The symphyseal is larger than the rostral. The inferior labials, four in number, gradually lose their width posteriorly; the third is the longest; the fourth is the smallest of all. There are five pairs of mental shields, diminishing in size posteriorly; the shields of the anterior pair being contiguous upon their inner margin. Between the inferior labials and the mentals a triple series of elongated scutellæ or shields may be observed, one series only extending to the posterior half of the anterior inferior labial and anterior mental shield. The temporal shields are well developed, slightly imbricated, rounded posteriorly, and carinated. The neck exhibits but a slight loose elevation of the skin, and is protected by acute and carinated scales, somewhat smaller than those of the back and sides. A small space immediately behind the ear is granular, though not as minutely as about the axillæ.

The dorsal scales are large, subrhomboid, subacute posteriorly, and strongly carinated; they are smaller upon the neck, and diminish gradually in size towards the sides of the body and along the tail, where they constitute longitudinal series, instead of being arranged in verticiles or else concentrically. Upon the origin of tail their posterior margin is rounded and subacute; farther behind they gradually elongate, and the carina, instead of occupying the middle line of the scale, becomes oblique. Along the inferior surface of that organ they are more uniform and more slender.

The limbs are very slender, and, when stretched alongside with the body, the anterior do not reach the setting on of the thighs, and the posterior the ear opening, in which respects, as in many others, this species may be distinguished from *P. gracilis*. The upper surface of these organs, from their origin to the tip of the fingers, is covered with carinated scales, similar in shape, though a little smaller than those of the sides of the back. They are plate-like on the upper surface of the fingers, and obsoletely carinated. On the palm of the hands and sole of the feet they are the smallest of all, except on the inferior surface of the arm and the anterior tibio-metatarsal region, where they approximate the granular aspect of the posterior surface of the thighs.

The inferior surface of the head, neck, and abdomen, is covered with uniform scutellæ, somewhat smaller under the neck, and likewise diminishing in size towards the sides of the abdomen. The average size of these scutellæ is smaller than the dorsal scales. Their posterior margin is rounded, and their surface slightly carinated from the chin to the preanal region, on the margin of which there are very small plates. The postanal region is granulated like the posterior surface of the thighs.

The ground-color is uniform deep brown, with a reddish tint from the posterior third of the body to half the length of the tail. The sides bear two parallel light vittæ, the uppermost extending from the occiput to the base of the tail, the other from the auditive aperture to the setting on of the hind legs. The inferior surface is unicolor, whitish or yellowish, with a me-

tallic tint of purplish under the head, greenish under the chest, and coppery under the belly and tail.

Collected near Santiago, Chile, where the species must be scarce, judging of it by the fact that only one specimen was found amongst the numerous of the other species.

Plate XXXVIII, fig. 13, represents *Proctotretus stantoni*, in profile and of the size of life.
fig. 14, the head seen from above.
fig. 15, side view of the head.
fig. 16, under view of the head.
fig. 17, anterior limb from beneath.
fig. 18, posterior limb from beneath.
fig. 19, dorsal scales.
fig. 20, abdominal scuttellæ.

Figs. 14—20 are slightly magnified.

We would not have concluded the history of the new members thus added to the "Fauna of Chile," by the exertions of the United States Naval Astronomical Expedition, without inscribing the name of one who was its father and its promoter, Hon. Fred. P. Stanton, of Tennessee. Science owes a debt of gratitude to all the enlightened men, who, by the position they hold in the councils of nations, declare themselves the patrons of scientific researches.

FAMILY OF LACERTIDÆ.

Genus APOROMERA, Dum. & B.

Gen. char. Base of tongue not sheathed, bifurcated upon its extremity, covered with subrhomboid and subimbricated papillæ. Teeth on the palate. Intermaxillary teeth conical and simple. Maxillary teeth compressed, apart, acute, and curved; the anterior ones simple, the following notched at the summit of their anterior margin. Perforation of nostrils from behind forwards, situated on the sides of the snout, near its extremity and between three or four plates. Eyelids present. A tympanic membrane stretched inside the auditive orifice. Transverse and simple folds under the neck. Ventral scutellæ small, quadrilateral, smooth, and disposed alternatively. No femoral pores. Hands terminated each by five, a little compressed, fingers, not carinated beneath. Five toes, with internal edge tubercular. Tail cyclo-tetragonal.

Syn. *Aporomera*, Dum. & B., Erp. gén. V. 1839, 69.
Guich. in Gay, Hist. de Chile, Zool. II, 1848, 58.

Obs. This genus embraces, as yet, but two species, both South American.

APOROMERA ORNATA, Dum. & B.

Plate XXXIX, Figs. 1—4.

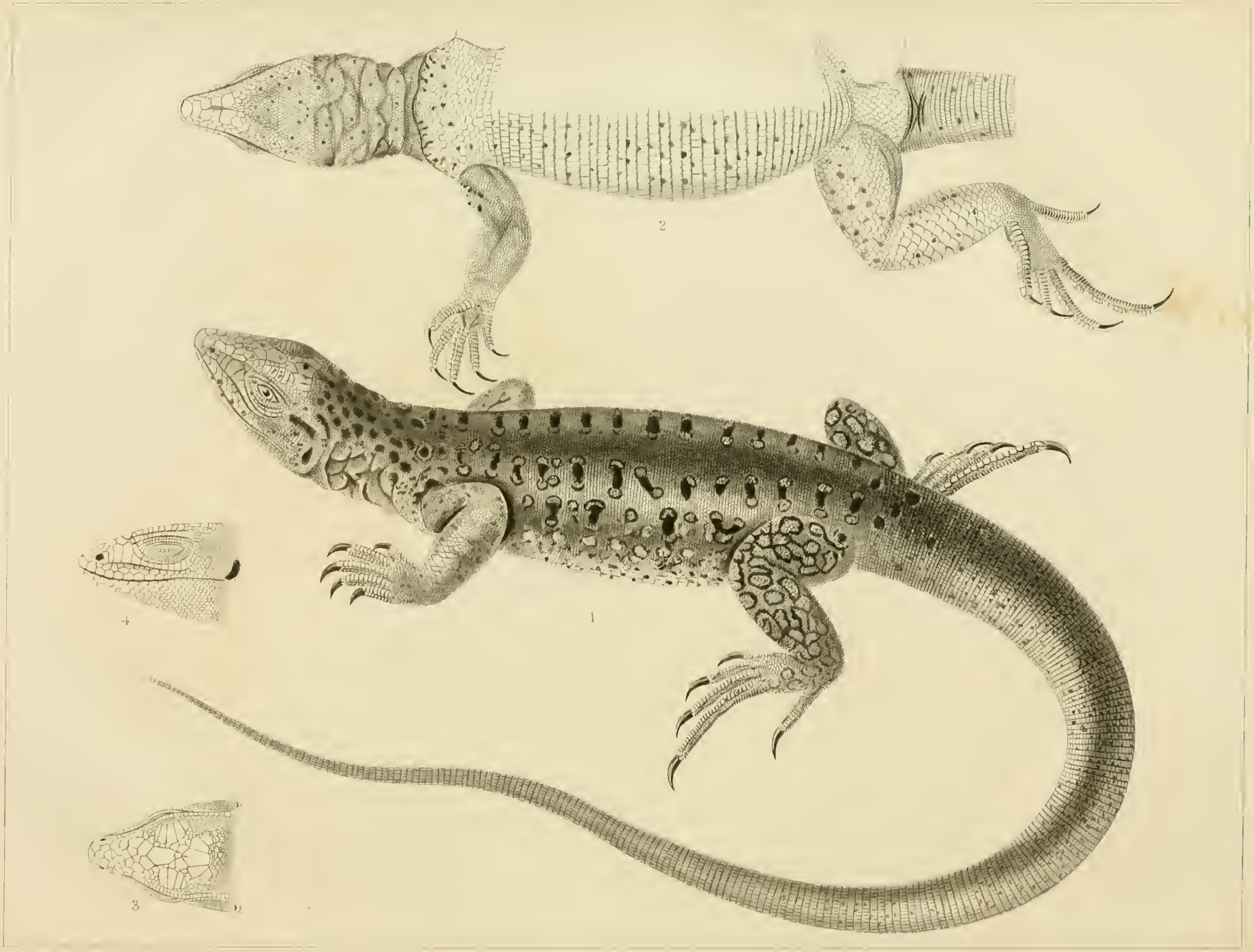
Spec. char. Cephalic plates subconvex and smooth. Auricular orifice subcrescentic, convex posteriorly and folded upon the latter margin. A double series of supralabial plates. Temporal shields small, polygonal, and rugose. Sides of neck folded and covered with small

subcircular scales. Dorsal scales subangular and moderate in size. Abdominal scutellæ quadrangularly elongated, disposed upon transverse series, and smooth. Tail longer than the body and head together. Above olivaceous, with four rows of black spots margined with white. Beneath yellowish white, spotted with black.

Syn. *Aporomera ornata*, Dum. & B. Erp. gén. V, 1839, 76.
Guich. in Gay, Hist. de Chile, Zool. II, 1848, 58, Plate iii, fig. 1.
Ameiva oculata, D'Orb. Voy. Amér. mérid. Rept. Plate v, figs. 6—9.

Obs. Finding that the iconography of this species might be considerably improved, under the circumstances, we have thought that such an opportunity ought not be allowed to pass without avail. The figures detailing its external structures are such as will throw a considerable light upon what is already known of that animal by those given in *Gay's Historia de Chile*, which, when compared to ours, cannot but attract the attention of herpetologists, as exhibiting some dissimilarities in the plates which protect the head.

Descr. The latter is subquadrangular or rather subconical, flattened upon its upper surface, and more or less swollen upon the temporal regions. The vertical plate is irregularly six-sided and broadest anteriorly. The occipitals are very numerous, most of them small and polygonal, irregularly disposed, save eight of them, occupying the middle of said region immediately behind the vertical. The foremost is very small and odd, situated in a notch of the posterior margin of the vertical. On its sides but a little behind, and obliquely disposed, are two larger plates as one pair. Immediately behind these first three, the largest of the occipitals may be observed, elongated, irregular, varying in shape, almost as large as the vertical, and having on either side a smaller plate as a second pair, exteriorly and behind which is a third pair still smaller. On some specimens two or three other pairs are observed, scarce larger than those covering the rest of the occipital region, and constituting two parallel series posteriorly to the third pair above mentioned. On the frontal region the plates are small and numerous, varying in absolute number as well as in form, and disposed without any marked regularity, save a somewhat concentric arrangement amongst the external ones; but this may not be constant in all the specimens. The rostral is broad and low, six-sided, the three upper sides concave or subconcave, the uppermost sometimes so small as to give to that plate a conico-pentagonal shape. There are three or four—one or two anterior, and two posterior—nasals. Between the nasals and the rostral is situated a conspicuous phrenic plate, exhibiting a large portion of its surface in an upper view of the head. The posterior prenasal (or prenasals) forms an oblique arch from the first upper labial to the upper portion of the nostril. The postnasals are the smallest, subquadrangular in shape, placed one above the other so as to limit equally the posterior edge of the nostrils, which is large and approximates the labials. The loral region is occupied by three rather large plates, much higher than broad, and increasing in size from forwards backwards. The inferior orbitals, nine or ten in number, form a continuous chain from the postero-inferior part of the eye to the surciliaries, increasing in size from backwards forwards, and provided with a carina from about beneath the pupil anteriorly. Thirteen or fourteen surciliaries constitute the upper edge of the orbit; these plates are small, subequal in size, a little larger anteriorly than posteriorly, and transversely elongated upon the middle of the chain. The upper and lower lids are densely covered with a pavement of irregular and small plates, disposed in series next to the inferior orbitals, where they are somewhat larger as well as anteriorly. Upon the edge of the lids they are likewise disposed in series, but not otherwise different from those on the middle region of these organs. Upon the upper lid they assume a granular aspect owing to their much reduced size. There are from five to seven suroculary plates transversely elongated, the middle one being the largest, and surrounded with small plates constituting one single series upon the region adjoining the vertex, and a double series exteriorly where these plates are the smallest of the group. The upper labials,



J.H.Richard Dougal Sc.

APOROMERA ORNATA, Dum & Bibr.

eleven or twelve in number, are of medium development, decreasing gradually in size posteriorly. The inferior labials, with nearly the same size, form, structure, and number as the upper, extend posteriorly to the same distance, which corresponds to a vertical line which would fall back of the eye. There is one row of small supralabials, largest anteriorly, extending from behind the first labial and beneath the nostril, to beneath the posterior half of the orbit. A second row may be traced from the second loral to the third or fourth suborbitals; and above there are a few more, as an indication, mayhap, of a third row, at all events very obsolete. The symphyseal is transversely elongated and obtusely angular upon the line of its contact with the labials and mental shields. There are four pairs of mental shields and an odd anterior one. The posterior pair is the smallest; the next to it or third pair is the largest in some specimens, whilst in others it is the second which has the pre-eminence in that respect. The odd plate is generally equal in size to those of the largest pair. The first, second, and anterior portion of the third pair come into close contact upon their inner margin, leaving no space for smaller plates to intervene. On the lower half of the temporal region, the plate or scales, whatever called, are quite small, and very minute on the upper half. On the sides of the neck which is folded, behind the ear opening and beneath it, they assume a granular aspect; they increase somewhat in size below, being uniform under the throat and subgular folds, which are considerably developed. They are large upon an area back of the mental shields, between which and the inferior labials a series of them intervene; also sensibly larger upon the middle and posterior part of the hoyid region.

The dorsal scales are uniform, moderate in size, and subcircular, disposed upon transverse irregular series from the head to the origin of tail, diminishing in size and uniformity towards the lower portion of the flanks. About the insertion of the limbs, and upon the thoracic region behind the arm, their appearance is granular.

The limbs are stoutish and well proportioned; the fore might be termed rather short, inasmuch as they do not extend much beyond the middle region of the body when stretched along its sides. But the apparent shortness of these limbs in that respect is owing to the fact that the body in this genus is proportionally much more elongated than in *Proctotretus*. The scales on the upper surface of the forearm and arm are larger than on the body; on the arm and carpus they assume the shape of scutellæ or plates, one row of which, transversely elongated, may be traced to the tips of the fingers. On the lower surface and palm of the hand they are again granular. There is a row of plates at the base of the metacarpus. The three external fingers are provided beneath with a double row of tuberculous plates, the two others with but one row, and all of them laterally with a series of small plates. The inner finger is the shortest, the external is the next in size, then the second; the third and fourth are equal in length. The nails are strong, of moderate development, compressed, acerated anteriorly, and curved: the plate, the upper and the lower, situated at their base, is the most developed of the digital series. On the upper surface of the hind legs and external half of the foot, the scales are nearly of the size of those on the back; the posterior surface is granular, as well as the sole of the foot, whilst the inferior surface and inner half of the foot are covered with scutellæ, larger under the tibial than under the femoral region; smallest on the foot. The toes are protected above with a series of transversally elongated and irregular scutellæ, and beneath with a series of tubercular plates. Their inner sides are granular, whilst on the outer sides the scutellæ of their upper surface meet the plates of the lower. The abdominal scutellæ are well developed, elongated, irregularly subquadrangular, and disposed upon transverse series. On the anterior portion of the chest these scutellæ are quite small, and irregularly disposed in advance of the arms. They diminish, likewise, in size towards the posterior region of the abdomen, preserving, however, their disposition upon transverse series. The preanal scutellæ are very irregular in their form, of moderate development, the central being the largest. The anal folds are granular. The tail is very long, sub or cyclo-tetragonal, tapering to a point, and covered with circular rows of elongated scales, increasing in size from the base

of that organ to the last fifth of its length. They are smooth upon the anterior fifth, hence to the tip conspicuously carinated, particularly upon the middle region; at the base of the tail the scales are but slightly larger than on the posterior portion of the body; they are smooth everywhere else except, as mentioned, upon the tail. The carination is gradually appearing under the shape of a blunt and small protuberance which may be seen upon the posterior extremity of the scales. Every other or every third row subdivides as it ascends from the sides of the tail towards its upper surface, from the base to about the third of the length, the subdivision gradually diminishing in extent until reduced to a few scales upon the middle of the upper region; hence backwards they constitute regular annular rows. The ground-color is olivaceous, varying in shade. From the occipital region to the base of the tail there are four longitudinal series of rather large black patches. The latter are subcircular or subquadrangular, transversally elongated, and provided laterally with a white line or spots, exteriorly again margined with a black filet; sometimes the black and central part of the blotch is wanting, in which case we have two independent white subrounded spots, margined with black. The occipital region is maculated with black. The inferior region of the flanks is vermiculated or spotted with brownish black, upon a whitish ground. The upper surface of the anterior limbs exhibits confluent lines or spots—some brownish, others whitish; the posterior limbs are maculated or else vermiculated with blackish. The upper surface of the tail presents intermingled black, brown, and olivaceous spots of various shades. The inferior regions are white; the throat, the belly, the thighs, and base of the tail are spotted with blackish brown.

Collected in the neighborhood of Santiago, Chile.

It is worthy of remark that *Ameiva oculata*, mentioned by d'Orbigny in his Travels to South America, was erroneously introduced in that work. The specimen from which his figure is made, is one of those collected by Claude Gay, in Chile, supposed for a time by the naturalists of the Garden of Plants in Paris to have been brought home by Alcide d'Orbigny, whose collections were deposited in that establishment, where Claude Gay had likewise sent his.

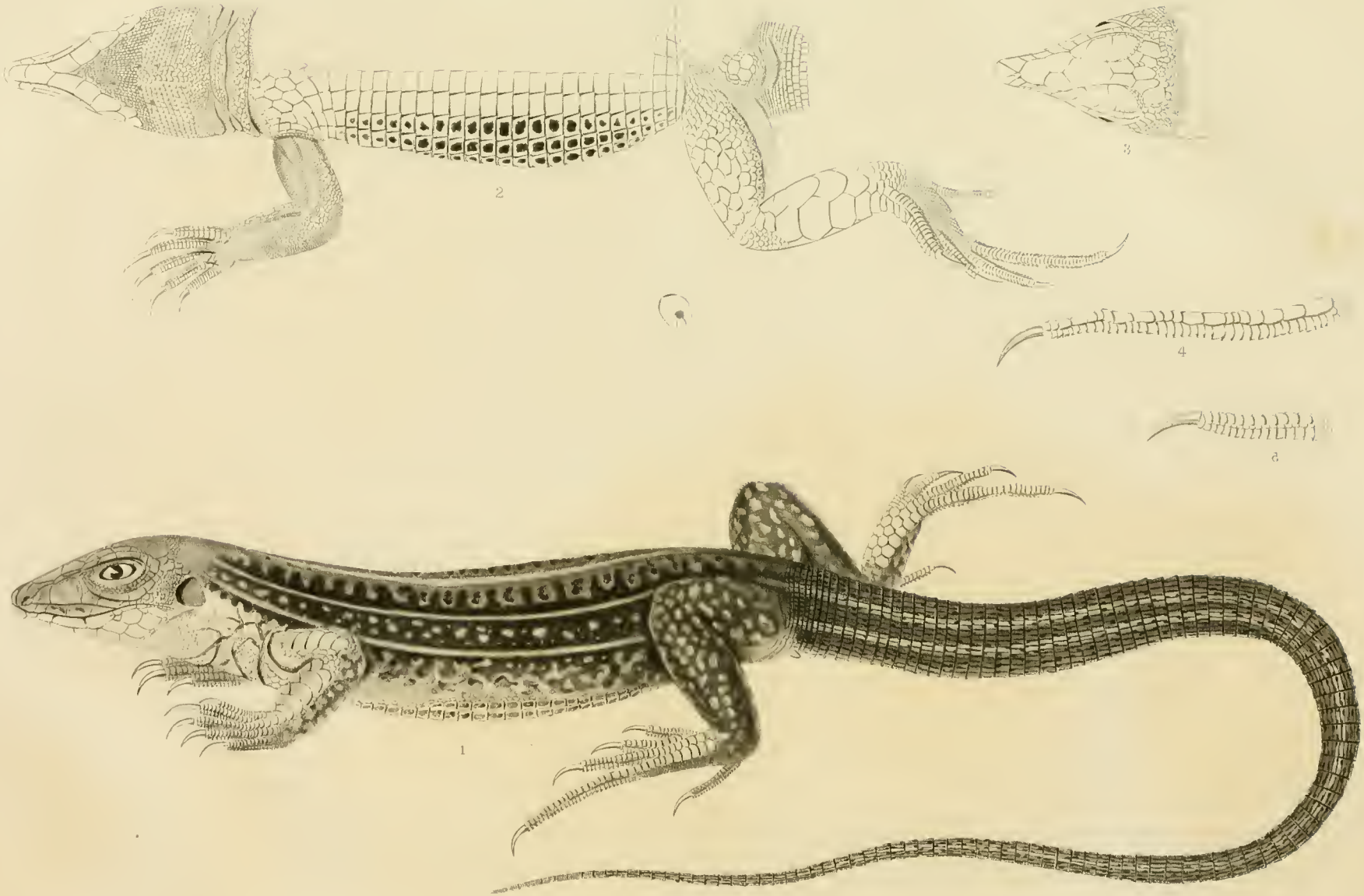
The shapes of the dorsal black spots, as described above, agree in the two specimens brought home by Lieut. Gilliss. They are at variance with those described and figured by Claude Gay.

Plate XXXIX, fig. 1, represents *Aporomera ornata*, in profile and size of life.
fig. 2, is an under view of the same specimen.
fig. 3, the head seen from above.
fig. 4, a side view of the head.

Genus CNEMIDOPHORUS, Wagl.

Gen. char. Base of tongue not sheathed, moderately long, divided upon its anterior extremity into two smooth filets, covered with scaly, rhomboid, and subimbricated papillæ. Palate toothed. Intermaxillary teeth conical and simple; maxillary teeth compressed; the anterior simple; the posterior tricuspid. External opening of nostrils situated either exclusively in a single naso-rostral plate, or between several nasals. Eyelids present. Tympanic membrane distinct, stretched inside the rim of the auditive aperture; a double transversal fold under the neck. Ventral scutellæ quadrilateral, flat, smooth, not, or little imbricated, disposed in alternate rows. Large scutellæ-like plates under the legs. Femoral pores present. Five fingers a little compressed, not carinated beneath. Five toes similar in structure to the fingers. Tail cyclo-tetragonal.

Syn. *Cnemidophorus*, Wagl. Nat. Syst. Amph. 1830, 154.
Dum. & Bibr. Erp. Gén. V, 1839, 123.



J.H.Richard

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CNEMIDOPHORUS PRÆSIGNIS, B. & G.

Obs. The species of this genus may be arranged into two groups, according to the number of longitudinal series of abdominal scutellæ, some having eight, the others ten of such series: the species described below belonging to the latter group.

CNEMIDOPHORUS PRÆSIGNIS, B. & G.

Plate XXXVIII, Figs. 1—5.

Spec. char. Abdominal scutellæ disposed upon ten longitudinal rows; dorsal scales very minute. Postsubgular fold provided with small plates upon its edge. Ground-color greenish, blotched with black, and exhibiting laterally two narrow, light vittæ.

Syn. *Cnemidophorus præsignis*, B. & G. Proc. Acad. Nat. Sc. Philad. VI, 1852, 129.

Descr. The head, which is contained twice and three-fourths of a time in the combined length of the neck and body, is subpyramidal in shape, slightly arched upon the occiput. The plates which cover its upper surface are well developed. The vertical is hexagonal, broadest anteriorly; it is preceded by a pair of postfrontals, narrowest upon the line of their junction, dilated exteriorly and rounded upon the latter margin. A large and unique prefrontal occupies nearly the whole width of the snout, being irregularly octagonal in its outline, touching posteriorly the postfrontals, exteriorly the loral and postnasal, and anteriorly the prenasals. The rostral occupies the entire width of the snout, advancing in a conical form towards the prefrontal, which, however, it does not reach. The prenasal is elongated and subquadrangular, being slightly curved backwards owing to its oblique situation on the sides of the snout, extending from the margins of the labials to the upper surface of the snout, where it meets its fellow from the opposite side, separating entirely the rostral from the prefrontal. The postnasal is not quite as high, though a little broader than the prenasal. It is anteriorly subconvex, and posteriorly concave, exhibiting a portion of its surface in an upper view of the head. The nostrils are large, situated at the inferior margin of the nasal plates, close to the labials, encroaching more upon the prenasal than upon the postnasal. The loral is very large, its convex anterior margin fitting the concave one of the postnasal. It is broadest anteriorly, and three-sided, offering points of contact to a surciliary and two anteorbitals, the lowermost being the largest, angular, and five-sided, whilst the upper one is elongated and narrow. There are two suborbitals, the anterior being twice as large as the posterior one. The postorbitals are numerous, small, and polygonal. Four surocularies and six surciliaries constitute the upper roof of the eye, the surciliaries forming a prominent ridge, between which and the surocularies a series of small scales may be observed, extending from the anterior margin of the second surocular and posterior margin of the second surciliary backwards, enclosing the posterior outline of the surocularies half way between the third of the latter group and the anterior occipitals. The anterior three surciliaries are much longer than the posterior three. The eyelids, upper and lower, are densely covered with small scales, the largest of which constituting a row along the inner margin of the orbitals. On the edge of the lids is another series more conspicuous than upon the intervening space. The middle surface of the lower eyelid is provided with a horizontal series of five or six quadrangular plates; the latter being higher than long. The occipitals are seven in number, the anterior two being somewhat larger than the others, broadest upon their posterior half, and in contact anteriorly with the vertical. The posterior five are disposed upon a sublinear and transverse row, the central one being placed immediately behind the middle line of the anterior two; the adjoining two, the largest of the five, are in contact anteriorly with the first pair of occipitals; the exterior two occupy a somewhat retreated situation along the external margin of the internal pair. An area of small plates surrounds posteriorly and exteriorly the postoccipitals. From the posterior extremity of the surciliary ridge to the upper mar-

gin of the auditive aperture may be seen a series of small polygonal plates, a continuation of the postorbitals. There are six upper labials; the two middle ones are much the largest, and longer than high. The anterior two are subquadrangular; the posterior two elongated, narrow, subtriangular; the last of the series is very small, with its acutest angle directed forwards, the reverse of the fifth. The inferior labials are seven in number, the posterior ones being very small and narrow; the third and fourth are very large; the second is nearly equal in size with the fourth upper labial, and the first nearly equal to the fifth of its own series. The symphiseal is semi-elliptical, and well developed. The submaxillaries or mental shields are very large; the anterior odd one is broadest; the second, on either side, are in contact for almost their whole length; the third and fourth diverge. Six or seven smaller plates, disposed upon a double row, terminate the submaxillary series at the angle of the mouth, and close to the anterior and lower rim of the auditive aperture. The latter is large and sub-circular, margined anteriorly with scales somewhat larger than those covering the middle of the temporal region. The extreme margin of the angle of the mouth is provided with small scales or else minute plates. The mental region, enclosed by the submaxillary plates, is covered with irregular and small scales, a narrow area of which may be seen extending to the lower edge of the auditive aperture. The anterior portion of the throat is provided with small polygonal plates, whilst the posterior portion of that region is covered laterally with minute, and upon its middle with rather small plates. The plates on the middle region of the posterior subgular fold are nearly equal in size to those of the anterior portion of the throat. On the margin of that fold they are again very small.

The anterior and upper surface of the forearm is provided with a series of five large polygonal and transversely elongated plates, surrounded with smaller ones, and beneath, posteriorly, towards the elbow, may be seen an area covered with about a dozen plates of a much smaller size, and rather subcircular than polygonal in their outline. The anterior and upper surface of the arm exhibits a series of transversely elongated plates, still larger and more numerous than on the forearm, surrounded likewise by smaller ones. The remaining portion of the surface of that limb is densely covered with small scales, assuming a plate-like aspect upon the middle region beneath and towards the elbow. The palm of the hand is covered with minute scales, and the metacarpus, opposite the external finger, is marked by a few small plates. The hand above is plated; the plates being a little smaller on the metacarpus than on the carpus. The fingers are protected above and below by a series of transversely elongated and uniform plates, extending to the very base of the nails. There is a lateral series of small scales separating the upper from the lower digital plates. The internal and external fingers are shorter than the others, and nearly equal in length. The middle one is a little longer than the adjoining two. The nails are well developed, compressed posteriorly, conical, acerated, and curved anteriorly. The anterior surface of the thigh is covered with plates of medium size, diminishing very much in size towards the inferior surface. The femoral pores, seventeen in number, limit the plated surface of that organ. They issue forth between an anterior subcrescentic small plate and two minute posterior ones. The inferior surface of the leg is covered with four longitudinal series of plates, very large upon the anterior series, and diminishing gradually in size upon the remaining series. The inferior surface of the metatarsus is protected by rather conspicuous and imbricated plates, whilst on the upper surface there exist minute scales. The tarsus exhibits four series of well-developed plates, which may be traced along the upper surface of the toes narrower upon the articulation of the phalanges than upon their middle region. The inferior surface of the toes is provided externally with a conspicuous series of small plates, and internally with two much smaller and irregular series placed along the thumb, the first (longest) and second toes, whilst these latter series are replaced by scales upon the fourth and fifth toes. The posterior surface of the tarsus is covered with minute scales, somewhat larger on the sole of the foot, between the thumb and the first (longest) and second finger. The plates on the upper surface of the tarsus and those on the inferior surface of the leg are contiguous upon the

external edge of the metatarsus behind the small toe. The nails are less developed than upon the anterior extremities, compressed at their base, acerated upon their extremity, and but slightly curved.

The dorsal and lateral regions of the body and upper surface of the hind legs are covered with very small and irregular scales. The inferior surface of the body is plated all over with quadrangular scutellæ, disposed upon ten longitudinal rows, the outermost of which is but imperfectly developed, upon the middle region of the abdomen. The second row, proceeding from the sides inwardly, is composed of scutellæ, nearly quadrangular, whilst on the three remaining rows the scutellæ are transversally longer, in the shape of an elongated quadrangle. Upon the anterior portion of the chest the series are interrupted and composed of smaller and irregularly-shaped scutellæ. The preanal region exhibits three rather large polygonal scutellæ surrounded by small plates, diminishing in size as they recede from the central group. The postanal region is densely covered with small plates or scales. The tail is long, subcylindrical, and tapering to a point. The scales which cover its surface are elongated and narrow, keeled upon their middle line, and disposed in verticiles or circular rows. On the upper part and sides of that organ the scales maintain the same width throughout their length, whilst inferiorly some of them may be seen slightly tapering posteriorly. The ground-color is greenish, the head, the locomotory members, and the tail, marmorated with black. Two lighter stripes may be seen running along the sides, the uppermost starting from the surciliary ridge, the lower one from behind the eye across the auditive aperture, and parallel towards the posterior extremity of the body. Hence, along the sides of the tail to a considerable distance, the uppermost uninterruptedly above the hind limbs, the lower one with a break near the origin of the thighs. The area enclosed by these two vittæ or stripes is black, provided upon its middle region with a series of greenish subrounded spots. The region of the flanks beneath the lower vitta is either entirely black, with two or three irregular series of greenish spots, or else the green and the black mingle, and assume a meandric aspect. The external three series of abdominal scutellæ are provided with a black spot upon their middle. The dorsal region enclosed between the uppermost vitta presents a medial, light-greenish band, edged with transverse blotches of black, enclosing a quadrangular space of deeper green, occasionally mottled with black. Upon the occiput and neck most of the space is greenish. It is not improbable that the young will be found to possess a more defined dorsal vitta, mayhap, similar altogether to those now to be observed on the sides. The inferior surface of the head, the chest, the middle region of the abdomen, and the preanal region, are uniformly yellowish-green. The inferior surface of the fore-limbs is yellowish, the inferior surface of the hind limbs and tail whitish, obsoletely blotched with blackish.

Specimens of this species were collected at Chagres, isthmus of Panama, by the late Prof. C. B. Adams, of Amherst College, Massachusetts.

Plate XXXVIII, fig. 1, represents the profile of *Cnemidophorus præsignis*, size of life.

fig. 2, is an under view of the same specimen, showing the varied structure of the plates, scales, and scutellæ, referred to in the above description; *a* is an enlarged view of one from a femoral pore.

fig. 3, exhibits the head from above.

fig. 4, an enlarged toe.

fig. 5, an enlarged finger.

FISHES.

BY CHARLES GIRARD.

FAMILY OF PERCIDÆ.

Genus PERCICHTHYS, Girard.

Gen. char. Body oblong or elongated, compressed, covered with scales of medium development, finely ciliated upon their posterior margin. Snout rather thick and blunt, overlapping slightly the lower jaw. Two dorsal fins contiguous at their base. Insertion of ventral fins immediately beneath the base of pectorals. Anal fin provided with three spiny rays. Tongue smooth. Upper surface of head, suborbitals and posterior dilatation of maxillary, covered with scales, as well as the cheeks and opercular apparatus. Suborbital and preopercle serrated. Opercle provided with a spine. Branchiostegals six or seven in number. Card-like teeth on the jaws; velvet-like teeth disposed upon a transverse band in front of the vomer and upon a narrow band along the palatines, sometimes only towards the anterior extremity of the latter bones.

Syn. *Percichthys*, Grd. Proc. Acad. Nat. Sc. Philad. VII, 1854, 197.

Obs. This genus, closely allied to *Perca*, is to be distinguished from it by the shape of the snout and the structure of the mouth; the presence of small scales on the top of the head, on the suborbital bones and (upper) maxillary; the position of the ventral fins, and by the presence of three spiny rays, instead of two, at the anterior margin of the anal fin. Moreover, the head, as a whole, has something of a sciænoid touch about it.

Perca trucha, of Cuv. and Val.* which, according to M. d'Orbigny, is an inhabitant of the Rio Negro of Patagonia, is a species of this genus.

I am led to consider *Perca ciliata*, K. and V. H., from the island of Java, *Perca marginata*, Cuv. and Val., brought to France from the austral hemisphere by the navigator Péron, and *Perca trutta*, Cuv. and Val., from Cook's straight (New Zealand), as properly referable to the genus *Percichthys*.

Should this be true, the hitherto cosmopolite genus *Perca* would thus be restricted to the boreal hemisphere; the analogous species of the austral hemisphere constituting an allied genus or several allied genera, since one of the species of this group has led us to the establishment of another genus equally distinct from both *Perca* and *Percichthys*.

Perca lævis, Jen.,† an inhabitant of the Rio Santa Crux, Patagonia, belongs also to the genus *Percichthys*, being closely allied to *P. trucha*, if at all distinct from it.

The following is the formula of its fins and branchiostegals:

$$\text{Br. } 7;\ \text{D. } 9-1/11;\ \text{A. } 3/9;\ \text{C. } 17;\ \text{P. } 15;\ \text{V. } 1/5.$$

Again, *Perca trucha* of Cuv. and Val. is not identical with the *Perca trucha* of the "Historia de Chile." The latter we propose to call *Percichthys chilensis*. The distinctive marks between

* Histoire Naturelle des Poissons. Tome IX, 1833, 429.

† Zool. of Beagle, IV. Fish. 1842, I, Pl. i.

J.H.Richard Dougal Sc

Fig. 1–4. [illegible]ENSIS, Grd Figs. 5–9. PERCILIA GILLISSI, Grd

the two are to be found in the structure of the anal, dorsal, and pectoral fins, the shape of the caudal, the size of the scales, and the course of the lateral line. In *Perca trucha* the anal is said to be short, the caudal slightly rounded, the scales small, and the lateral line nearly straight. Now, in *Percichthys chilensis* the anal is long and deep, the caudal is emarginated, the scales are rather above than below the middle size, and the lateral line forms quite a conspicuous curve along the dorsal region of the body, being straight only along the peduncle of the tail. The formula of the fins of *Percha trucha*, given by Cuvier and Valenciennes, is as follows:

D. 9 — 1/13; A. 3/10; C. 17; P. 14; V. 1/5.

which, according to our method, will read thus:

D X. 13; A III. 10; C O. I. 8. 7. I. O; V I. 5; P 14.

and compares better with the formula of *Percichthys chilensis* given further on. The rudimentary rays of the upper and lower lobe of the caudal are not enumerated by the French ichthyologists. It is to be regretted that their formula passed into the "Historia de Chile" without verification upon the specimens collected by Mr. Gay, on the ground merely that Cuvier pronounced both species identical. It is true, they are called *trucha* both in Patagonia and Chile; but this is one instance in many of vernacular names similarly applied to more than one zoological species.

None of the specimens which came under my observation did exhibit roundish black spots as figured in the "Historia de Chile," which may after all become another distinguishing feature between the *trucha* of Patagonia and the *trucha* of Chile. To this, however, I attach no greater importance than it is worth.

PERCICHTHYS CHILENSIS, Girard.

PLATE XXIX, Figs. 1—4.

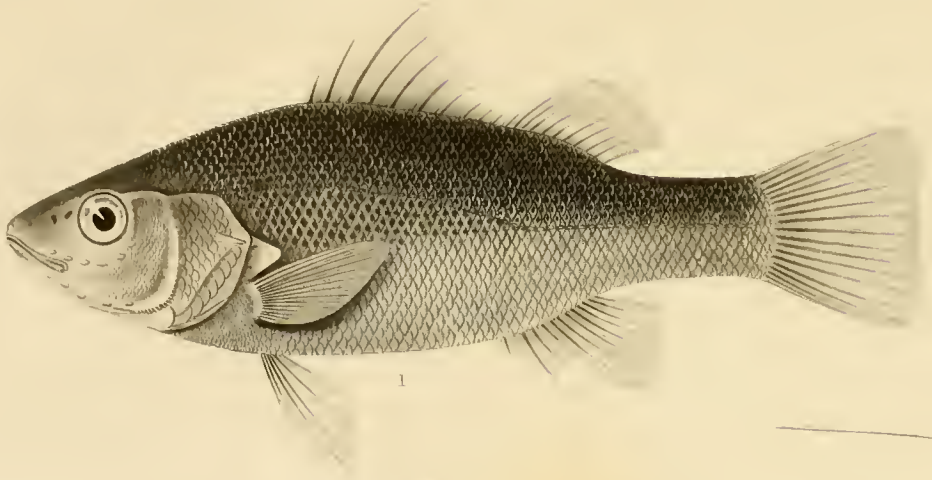
SPEC. CHAR. Snout subconical, obtuse anteriorly, and slightly overlapping the lower jaw. Mouth well developed. Posterior extremity of upper maxillary fetching the vertical of centre of pupil. Limb of preopercle conspicuously serrated; exterior margin of sub and interopercle inconspicuously so. Soft portion of anal deeper than the height of second dorsal. Caudal moderately emarginated posteriorly. Branchiostegals seven. Ground-color yellowish; upper regions covered with brownish or blackish diffused spots.

SYN. *Percha trucha*, GUICH, in *Gay*, Hist. de Chile, Zool. II, 1848, 146; Ictiol. Lam. I bis. fig. 1.
Percichthys chilensis, GRD. Proc. Acad. Nat. Sc. Philad. VI, 1854, 197.
Trucha, vernacular.

DESCR. The body is subfusiform, compressed, and more elongated than in the common perch of the United States. The greatest depth, which corresponds to the origin of the first dorsal fin, is contained four times and a half in the total length; whilst the least depth, taken on the peduncle of the tail, enters in the same length nearly ten times. The back is uniformly arched from the nape to the termination of the second dorsal. The peduncle of the tail constitutes almost the fifth of the whole length. The abdominal outline is convex from the throat to the end of the anal fins. The greatest thickness is a little more than half of the depth; the thickness of the peduncle of the tail is exactly the half of its depth. The head, which is subconical, is continuous with both the dorsal and abdominal outlines, if we except a very slight depression upon the vertex. It forms about the fourth of the entire length. The

snout, which is rounded and obtuse, slightly overlaps the lower jaw, which is thus entirely concealed when the fish is viewed from above. The mouth is of medium size; its angles do not reach the anterior margin of the orbit. The posterior extremity of the upper maxillary extends to a vertical line, which would intersect the pupil. The teeth on both of the jaws, as well as those on the front of the vomer and on the palatines, are small and more card than velvet-like. They cover an elongated and narrow area along the palatines. The posterior nostril is the largest, subtriangular in shape, and situated close to the anterior rim of the orbit; the anterior nostril is circular, and opens a little in advance of the latter. The eye is subcircular, approximating the upper outline of the profile; its horizontal diameter enters five times in the length of the side of the head. The inferior edge of the suborbitals is minutely serrated; these bones overlap considerably the upper maxillary when the mouth is shut. The limb of the preopercle exhibits small and closely set serratures upon its ascending branch, whilst the inferior and horizontal branch is provided with fewer spines directed downwards and slightly forwards. Minute serratures may be observed upon the exterior edge of both the inter and subopercles. The opercle is trapezoid, and obliquely traversed by a flattened spine in close union with that bone, allowing its extremity only to project beyond its margin just above the upper extremity of the subopercle. The interopercle is a well developed piece of the apparatus of which it constitutes a part. The thoracic belt is robust; the serratures of the suprascapular are conspicuous, and the coracoid sends off quite a broad expansion above the base of the pectoral fins, the margin of which expansion is provided with minute spines. The branchial aperture is wide; there being no isthmus under the throat. The branchiostegals, seven in number, are slender and flattened upon the posterior half.

The distance between the origin of the first dorsal fin and the tip of the snout is equal to the combined base of both dorsals. There are eleven spiny rays, eight of which constituting what may properly be considered as the first dorsal fin; the ninth and tenth seem rather to fill up the space between the two fins, and the eleventh occupies the anterior margin of the second dorsal. The first ray is short and equal in height to the eighth, but more slender; the second is a little higher than the sixth; the seventh being intermediate between the sixth and eighth; the third is the highest of all, and thrice as high as the first; the fourth is slightly shorter than the third, and the fifth intermediate between the fourth and sixth. The upper outline of that fin is consequently very convex. The membrane between the rays is deeply indentated. There is no vacant area between the first and second dorsals; as already observed, there are two slender spines, shorter than the eighth, which connect these two fins; their direction or inclination seems more alike the rays of the second dorsal than those of the first. The eleventh spine, that which forms the anterior margin of the soft dorsal, is about the same height as the eighth. The second dorsal is higher than its base is long, though not quite as high as the highest spine of the anterior dorsal. Its upper margin is slightly convex; its soft rays are twice bifurcated, except the anterior one, which is simple; the anterior branch of the second ray remains also simple. The last ray being double, its posterior branch divides but once; whilst its anterior portion divides once upon its posterior division, and twice upon its anterior, alike the other rays. The anal is preceded by three spines; the anterior one being the shortest, is immediately opposite the anterior margin of second dorsal; the second spine is nearly twice as long as the first, whilst the third is a little shorter than the second; the membrane which unites them is deeply indentated. The soft portion of the anal is deeper than the second dorsal is high, and deeper than its own base, equal, however, in depth to the base of the whole fin, its spiny rays included. The tips of its soft rays project a little further posteriorly than those of the second dorsal. The bifurcation of the soft rays is similar to what is observed in the second dorsal. The caudal is broad and moderately long, being contained about six times and a half in the total length. Its posterior margin is subcrescentic or else moderately emarginated, the lobes being rather obtuse. The central rays bifurcate thrice upon their length. The insertion of the ventrals corresponds to the base of the pectorals. The spine which occupies



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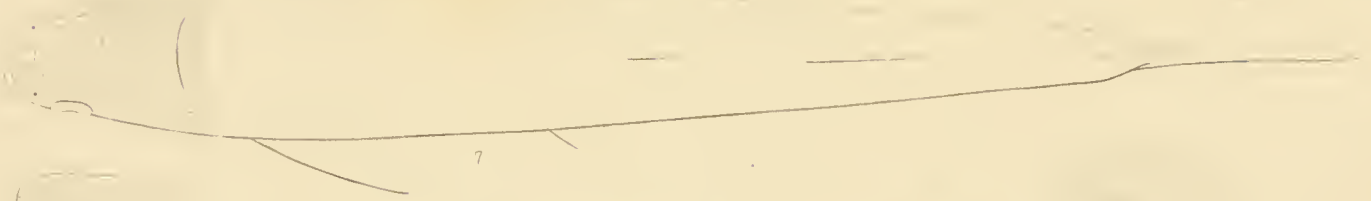

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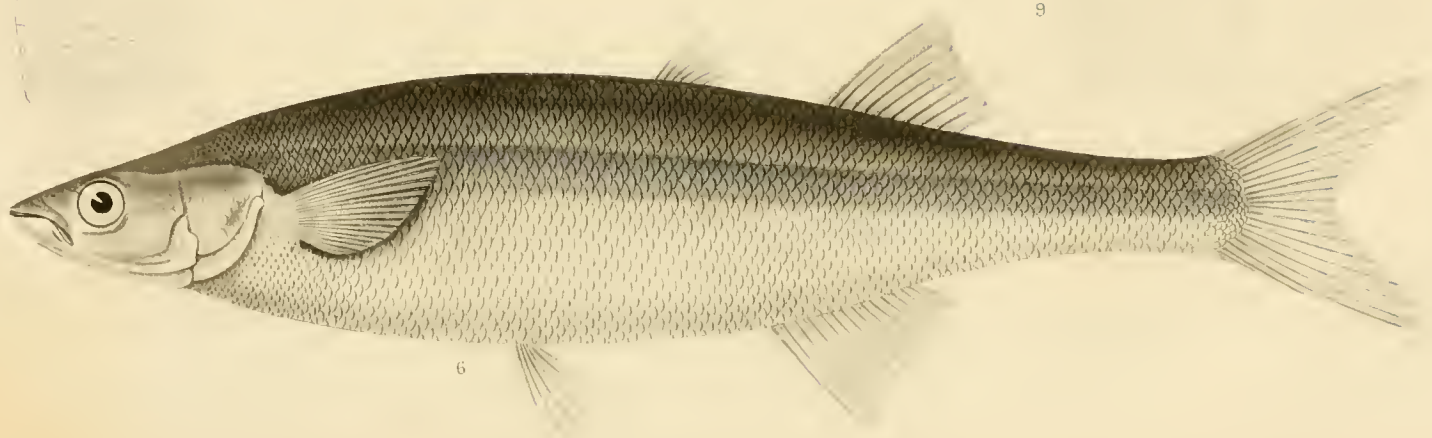

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their exterior margin is long and acute, though shorter than any of their soft rays, which bifurcate thrice, save the posterior one, which divides but twice, and the anterior only once. Their external margin is broad and rounded. The pectorals are a little longer than the ventrals, broad exteriorly when expanded, and composed of soft and slender rays, which bifurcate but twice upon their length.

Br. VII; D XI. 10+1; A III. 10; C 4. I. 8. 7. I. 3; V I. 5; P 16.

The scales are well developed, minutely serrated upon their posterior margin, which is convex or rounded. Their anterior margin is subtruncated, whilst their upper and lower margins are almost rectilinear. Eight distinct rows may be counted between the anterior margin of the first dorsal and the lateral line, and from twenty-two to twenty-five beneath it and the ventral line. They diminish considerably in size upon the sides and belly, becoming very minute under the throat. The upper surface of the head and the cheeks, the suborbitals and maxillary are covered with them, smaller, however, on the cephalic region proper than on the cheeks, and quite minute on the maxillary. Those covering the opercular apparatus are again large and conspicuous, being nearly as large as those of the trunk. The lateral line is very conspicuous; there are in it from sixty-eight to seventy scales. From the upper part of the opercular apparatus it constitutes a gradually raised curve to nearly opposite the posterior portion of spiny dorsal; hence the curve is continued, gradually descending to nearly opposite the posterior margin of the soft dorsal by a series of undulations; then runs almost straightway to the base of caudal, along the middle of the peduncle of the tail.

The coloration is of a golden yellow; the upper part of the flanks and dorsal region being brownish or blackish owing to the presence of diffused spots and maculæ. The fins are unicolor, greyish yellow. The inferior surface of the head is whitish.

This fish is said to inhabit most of the rivers of the republic of Chile. The specimen figured, together with several others, was caught in a tributary of the Rio de Maypu, near Santiago.

Plate XXIX, fig. 1, represents, size of life, *Percichthys chilensis*, seen in profile.
fig. 2, is a scale of the dorsal region.
fig. 3, a scale from the lateral line.
fig. 4, a scale of the abdominal region.

Figs. 2, 3, and 4 are magnified.

PERCICHTHYS MELANOPS, Girard.

Plate XXX, Figs. 1—5.

Spec. char. Mouth of moderate size, posterior extremity of upper maxillary reaching the vertical of the anterior rim of orbit. Palatine teeth occupying but a small area towards the anterior extremity of these bones. Opercular spine not very conspicuous. Branchiostegals, six. Ground-color whitish, minutely and densely dotted with black; dots crowding upon the middle of the scales under the shape of a central blotch, giving to the whole fish quite a dark hue.

Syn. *Percichthys melanops*, Grd. Proc. Acad. Nat. Sc. Philad. VII, 1854, 197.

Descr. This species does not apparently attain a very large size, judging of it from the fact that the specimen figured is the largest of the lot collected. It bears a general resemblance to *P. chilensis* above described, having the same general shape of the head and body; but the peduncle of the tail being less developed, its aspect is rather more contracted. The greatest depth of the body, which corresponds to the anterior margin of the first dorsal fin, is equal to the length of head, and is contained about three times and three-fourths in the total length; whilst the least depth, taken on the middle of the peduncle of the tail, enters in that same

length about nine times, or a little over. The greatest thickness stands, in regard to the length, as one to six or two to thirteen. The dorsal outline is more convex than in *Percichthys chilensis*, and mayhap also the belly, which contributes not in a small degree to give to this fish that more contracted appearance already alluded to above. The head is sub-conical, and participates in the short aspect of the body. Its upper surface continues, towards the tip of the snout, the declivity of the nape with scarcely any inflexion upon either the occiput or the ocular region. The snout itself is blunt and rounded, slightly overlapping the lower jaw when the mouth is shut. The upper arcade of the mouth is but little protractile, and, when in the latter state, causes the maxillaries to move more downwards than forwards. There are minute card-like teeth on both the upper and lower jaws, and closely set together. Velvet-like teeth may be observed on the front of the vomer, disposed upon a small triangle. The palatines exhibit a few rudimentary teeth upon their anterior extremity in contact with the vomer. The palate is otherwise smooth. The pharyngobranchials are large, elongated, and convex, and closely set with prickly teeth; the inferior pharyngobranchials are smaller, subtriangular, and slightly concave, likewise set with similar teeth. The tongue is smooth, flattened, tapering anteriorly. The mouth is moderate, the posterior extremity of the upper maxillary reaching a vertical which would pass in advance of the orbit only. The eye is subcircular, and well developed; its horizontal diameter being contained a little over four times in the length of the side of the head. The anterior suborbital is broadly developed, overlapping considerably the upper jaw. Its external edge is minutely crenated. The serratures of the ascending branch of the preopercle are rather more developed than in *P. chilensis*, though the spines on the lower branch are proportionally of the same size. The opercular apparatus, as a whole, is constructed upon the same pattern in both *P. chilensis* and *P. melanops*. The inferior margin of the sub and interopercle are similarly crenated, and a flattened spine may be seen across the middle of the opercle, extending its point beyond the edge of that bone, mayhap a little more acute and more conspicuous in *P. melanops* than in *P. chilensis*. The suprascapular is likewise crenated, and the coracoid expansion above the base of pectoral fins, wanting, however, the minute spines observed in *P. chilensis*. The branchiostegals, six in number, are flattened and curved. The gill openings communicate together under the throat, being shaped exactly as in *P. chilensis*.

The distance between the tip of the snout and the origin of the first dorsal is a little greater than the base of both dorsals. The general structure of these fins is the same as in *P. chilensis*, with the exception that the third spine is the longest instead of the fourth. The membrane between the spines is deeply emarginated. Eight rays constitute, properly speaking, the anterior fin; two are intermediate between the eighth and the eleventh, which is situated at the anterior margin of the second or posterior fin. The central rays of the latter bifurcate also twice, and their tips extend evenly with those of the anal. The anal is preceded by three spines, and its soft rays are bifurcated in the same manner as those of the second dorsal. The posterior margin of the caudal is subemarginated with its central rays thrice bifurcated; it constitutes a little less than the sixth of the entire length of the fish. The origin of the ventrals corresponds to a vertical line which would pass immediately behind the base of the pectorals. They are broad and rounded exteriorly; their central rays being bifurcated three times, with the anterior spine longer than in *P. chilensis*. The pectorals are rather short, and broad when expanded; their tips do not extend as far backwards as those of the ventrals; the rays are slender and bifurcate twice.

Br. VI; D XI. 10; A III. 9; C 6. I. 8. 7. I. 5; V I. 5; P 15.

The scales are of medium development, and very minutely, if at all, crenated upon their posterior margin, which is irregularly rounded. Their anterior margin is straight, and the upper and lower edges linear and parallel, the scales being much longer than broad. There are ten distinct rows between the lateral line and the anterior margin of the first dorsal, besides some few irregularly disposed near the base of that fin; twenty rows and more may be counted

between the lateral line and the medial region of the belly. The scales decrease in size towards the occiput and the middle of the back, as well as towards the belly and throat. They are quite small on the cheeks, and so are those that are observed on the upper surface of the skull, on the suborbitals and maxillary. On the opercular pieces they are nearly as large as those on the flanks. The lateral line, in which fifty-eight to sixty scales may be counted, forms an arch from the upper part of the opercular apparatus to nearly opposite the anterior margin of the second dorsal, where it reaches the middle of the flanks, hence straight to the base of the caudal.

A dark blackish hue seems to pervade all the body and head, and yet the ground-color is whitish, mayhap sometimes yellowish. Innumerable black dots thickly spread over all the regions contribute to give to this fish its dark appearance. These dots being more particularly crowded upon the posterior third of the scales, it seems as if each scale bore a small spot or blotch. The upper surface of the head is uniformly dark brown or blackish. The sides of the head and opercular apparatus appear obsolately maculated. The inferior surface of the head, the throat, and the belly, exhibit more of the ground-color. The fins are all more or less yellowish, intensely dotted with blackish, so as to assume the general dark hue of the body itself, particularly the dorsals and caudal.

This species inhabits the hydrographic basin of the Rio de Maypu. Specimens were procured from the neighborhood of Santiago.

Plate XXX, fig. 1, represents *Percichthys melanops*, size of life.
fig. 2 is an outline, viewed from above.
fig. 3, a scale from the dorsal region.
fig. 4, a scale from the lateral line.
fig. 5, a scale from the abdominal region.
Figs. 3, 4, and 5 are magnified.

Genus PERCILIA, Girard.

Gen. char. General physiognomy percoid; body compressed. Two dorsal fins, contiguous at their base, broadly separated in their outline. Mouth rather small, or else of medium size; jaws subequal. Small conical teeth upon the maxillaries, and a few card-like ones on the front of vomer; none on the palatines. Tongue smooth. A few minute spines along the limb of preopercle. Opercle without any spines. External edge of suborbitals, sub and interopercle not crenated. Branchial aperture of either side continuous under the throat. Branchiostegals 5 to 6 in number. Scales quite large and posteriorly ciliated. Cheeks and opercular apparatus scaly; top of head nearly smooth and nacked. Suborbitals and maxillary scaleless. Insertion of ventrals behind the base of pectorals. Caudal posteriorly subcrescentic.

Syn. *Percilia*, Grd. Proc. Acad. Nat. Sc. Philad. VII, 1854, 197.

Obs. The genus *Percilia* is a diminutive percoid, essentially characterized by a small mouth, the absence of palatine teeth, and an opercular apparatus nearly smooth, there being but a few minute needle-like spines along the limb of the preopercle. The maxillary teeth differ widely from those of *Perca* and *Percichthys*. The anal has three spiny rays, as in *Percichthys*, but the position of the ventrals takes place as in *Perca*. Its general physiognomy resembles more that of *Percichthys melanops* than any other member of the family. The shape of the head and structure of the mouth denote an affinity with *Percichthys*, whilst the absence of scales on the upper surface of the head, the suborbitals, and the (upper) maxillary, remind us of similar traits in true *Perca*.

PERCILIA GILLISSII, Girard.

PLATE XXIX, Figs. 5—9.

SPEC. CHAR. Snout short and rounded; mouth small; posterior extremity of upper maxillary corresponding to the vertical of the anterior rim of the eye. A few minute spines upon the angle of preopercle. Scales large, conspicuously ciliated posteriorly. Ground-color light reddish, or reddish brown, maculated with black.

SYN. *Percilia Gillissii*, GRD. Proc. Acad. Nat. Sc. Philad. VII, 1854, 197.

DESCR. This is a comparatively small species, and in all probability the specimens before us are full-grown ones. The largest we have seen measure about three inches and a half in total length, of which the head constitutes the fourth part. The dorsal and abdominal outlines are convex, giving to the whole profile a fusiform aspect. The peduncle of the tail is moderately developed, and rather narrow. The greatest depth, measured in advance of the first dorsal, is contained three times in the length, the caudal fin excluded; the least depth, taken on the peduncle of the tail, enters seven times in the same dimension. The greatest thickness equals half the greatest depth. The body, therefore, is much compressed. The occipital region is slightly depressed. The snout is short and rounded, and the upper jaw, which is slightly protractile, overlaps a little the lower one. The mouth is quite small, the posterior extremity of the upper maxillary extending to a vertical line, which would pass immediately in advance of the anterior rim of the orbit. The maxillary teeth are small, subcylindrical, slightly tapering towards their point, and disposed upon several rows. The front of the vomer is provided with a subtransverse narrow band of card-like teeth, and not very conspicuous. The palatine bones are smooth. The pharyngobranchials are well developed, and densely covered with minute prickles. The tongue is smooth, small, semi-elliptical in shape, and very much flattened, mayhap more swollen in a living state. The eye is of medium size, and subcircular; its horizontal diameter being contained nearly four times and a half in the length of the side of the head. The preopercle exhibits but a few minute spines upon its limb; the opercle has no spine at all; and the inferior edge of both the sub and interopercle is entire, or else not crenated. The gill openings are continuous under the throat, but there is a membranous expansion between the adjoining branchiostegals, thus filling up a space which is open in the species of *Percichthys*, above described. The branchiostegals are five or six in number, flattened, and recurved. The suprascapular is not visible externally; the coracoid expands much less above the base of pectorals than in *Percichthys;* and, moreover, these bones are neither provided with spines nor crenated upon their edges.

The dorsal fins are similar in general appearance to those of the foregoing percoids; the membrane which unites the spines is deeply emarginated; but the two intermediate spines between these two fins do not exist in this species. There are, consequently, nine dorsal spiny rays. The ninth, which is closely connected with the posterior fin, is the smallest of all; the eighth comes next, and is but very little higher than the latter; the others increase in height, as follows: first, seventh, sixth, second, fifth, third, and fourth. There are instances where the third is slightly higher than the fourth, as is also the case in *Percichthys chilensis*. The second dorsal is not quite as high as the first, though a little higher than its own base; on the other hand, the base of the first dorsal is longer than its height. The middle rays bifurcate twice upon their length, and their tips extend a little further backwards than those of the anal. The latter is preceded by three spines similar to those in *Percichthys chilensis* and allied species. A few of the central soft rays exhibit traces of a bifurcation of the third order; the others are as in the second dorsal, the external margin of which fin is rounded or subconvex, as is the case in the anal. The caudal is broad and subcrescentic upon its posterior edge, the central rays bifurcating three times. The insertion of ventrals is situated behind the base of the

pectorals, and their tips extend further backwards. Their spiny ray is well developed, and the central soft ones bifurcate three times upon their length. The pectorals are short, and rounded when expanded, composed of slender rays which bifurcate only twice.

Br: V—VI; D IX. 11; A III. 8; C 4. I. 8. 7. I. 3; V I. 5; P 14.

The scales are large, provided posteriorly with slender and filiform serratures. They are higher than long, anteriorly subtruncated, and rounded upon the other sides of their outline. Four longitudinal rows are observed between the anterior dorsal and the lateral line, and about twelve rows beneath, between the latter and the middle line of the belly. They diminish in size towards the occiput and nape, as well as towards the inferior surface of the body. The largest may be seen upon the middle of the flanks. The upper surface of the head is nacked and perfectly smooth. Small scales exist on the cheeks, and somewhat larger ones on the opercular apparatus. The suborbitals and the maxillary are scaleless. The lateral line, in which there are about thirty-five scales, from the upper part of the opercle to opposite the middle region of the second dorsal fin, constitutes a depressed and occasionally somewhat undulating arch; then runs nearly straight towards the base of the caudal fin.

The ground-color assumes either a light reddish or reddish brown hue. The head, dorsal region, and sides of body and tail, are irregularly blotched with blackish or deep brown—the blotches being the result of an accumulation of minute dots. The lower surface of the head and throat are sown over with similar dots sometimes disposed in irregular streaks. The ground-color of the fins is light yellowish, the rays made blackish by crowded dots; the pectorals and ventrals less so than the dorsals, caudal, and anal.

Inhabits the Rio de Maypu; specimens were obtained from an affluent of that river, in the vicinity of Santiago.

Plate XXIX, fig. 5, represents the profile of *Percilia gillissii*, size of life.
fig. 6 is an outline, viewed from above.
fig. 7, a scale of the dorsal region.
fig. 8, a scale of the lateral line.
fig. 9, a scale of the abdominal region.
Figs. 7, 8, and 9 are magnified.

FAMILY OF ATHERINIDÆ.

The study of this family, heretofore composed of the single genus *Atherina*, has led us to establish several new genera in which the rather numerous species are grouped according to several structural peculiarities which, though apparently inappreciable on account of their moderate development, are not to be altogether overlooked.

The genus Atherinopsis is to receive such species in which there are no palatine teeth, with both jaws equal, and the snout more or less rounded.

Atherina menidia, Linn., and *Atherina notata*, Mitch., will find a place in this genus alongside with *Atherinopsis californiensis*, Grd.

The genus Basilichthys will be characterized by the protrusion of the upper jaw beyond the lower one. There are no teeth on the palate.

To this must be referred:

1°. *Atherina microlepidota*, Jen., from the fresh waters of Chile, described further on.

2°. *Atherina laticlavia*, Cuv. and Val.,* from the coast of Chile, and easily distinguished by its large scales and its broad silvery lateral band.

3°. *Atherina argentinensis*, Cuv. and Val., observed at the mouth of the Rio La Plata and Bay of Maldonado, and commonly known as *Pescadilla del rey*.

* Hist. Nat. des Poiss. X, 1835, 473.

4°. *Atherina macrophthalma* AGASS.,* *A. brasilensis*, CUV. and VAL.; from the bay of Rio de Janeiro.

5°. *Atherina bonariensis*, CUV. and VAL., from Buenos Ayres.

6°. *Atherina lichtensteinii*, CUV. and VAL., from Montevideo.

And, in all probability: *Atherina regia*, HUMB.,† from Peru, and *Atherina lessonii*, CUV. and VAL., from Brazil.

The genus HETEROGNATHUS is based upon the elongation of the lower jaw, which projects considerably beyond the upper one. No teeth on the palate, or else in a rudimentary state only.

Atherina humboldtiana and *A. vomeriana*, CUV. and VAL., both from Mexico: whether from the fresh or salt waters, it is not stated.

In all *Atherinopsis*, *Basilichthys*, and *Heterognathus*, the intermaxillaries constitute the upper arcade of the mouth at the exclusion of the maxillaries, which are situated behind the latter. This character will distinguish them at once from *Atherina* proper.

Genus BASILICHTHYS, Girard.

GEN. CHAR. Intermaxillaries constituting the upper part of the mouth, the maxillaries being placed behind. Head and snout subconical; upper jaw protruding beyond the lower. Small teeth on both jaws; none on either the vomer or palatines. Upper surface of the head scaly.

SYN. *Basilichthys*, GRD., Pro. Acad. Nat. Sc. Philad. VII, 1854, 198.

OBS. Like *Atherinopsis*, the present genus includes species of its family which are unprovided with teeth of any kind on the upper roof of the mouth. The mouth itself has the same general structure as regards the disposition of the intermaxillaries and maxillaries, but the conical shape of the head, and the protrusion of the upper jaw beyond the lower, will constitute the generic feature of *Basilichthys*.

BASILICHTHYS MICROLEPIDOTUS, Girard.

PLATE XXX, Figs. 6—9.

SPEC. CHAR. Upper surface of head depressed and subconvex. Cheeks and upper portion of opercle covered with conspicuous scales. Origin of anal considerably in advance of anterior margin of second dorsal. First dorsal opposite the middle of space between anals and ventrals. Caudal forked. Ground-color yellowish brown, dotted with blackish; a silvery grey band along the middle of the flanks.

SYN. *Atherina microlepidota*, JEN. Zool. of Beagle, IV, Fish. 1842, 78, Pl. xvi, fig. 1, 1*a*, 1*b*.
GUICH. in *Gay*, Hist. de Chile, Zool. II, 1848, 253.
Basilichthys microlepidotus, GRD. Acad Nat. Sc. Philad. VII, 1854, 198.
Peje rey, vernacular.

DESCR. The general form is elongated, subfusiform, and slender; the back being rounded, whilst the flanks diminish considerably in thickness from the silvery band towards the medial line of the belly. The greatest depth of the body, measured above the insertion of the ventral

* Pisc. Brazil, 1827, Pl. xlvii, Fig. 1.

† Rec. d'Obs. de Zool. et d'Anat. Comp. I, 1833.

fins, is contained between five and six times in the total length; and the least depth, taken on the peduncle of the tail, near the base of the caudal fin, is about the third of the greatest depth. The greatest thickness is considerably more than half the greatest depth. From the origin of the ventral the body tapers slightly anteriorly, and quite rapidly posteriorly from the anterior margin of both the anal and second dorsal fins.

The head above is depressed, subconvex, and rather small. In length it constitutes about the two-elevenths of the whole. It is a little deeper than broad at its base. The mouth is well developed, the lower jaw being a little shorter than the upper, which is protractile. Several rows of very small and subconical teeth may be observed on the maxillaries and on the dentaries. The palate is perfectly smooth, or without teeth. The pharyngobranchials, upper and lower, are densely covered with card-like teeth. The tongue is smooth and narrow, and of but medium development. The posterior extremity of the upper maxillary does not quite extend to a vertical line which would pass through the anterior rim of the orbit. The nostrils are very small, the anterior one being the smallest, and both of them are nearer to the anterior rim of the orbit than to the lip of the upper jaw when the latter is in its retracted position. The eye, though well developed, is small when compared to other species, circular in shape, and its diameter contained nearly five times in the length of the side of the head. Its upper margin approximates the line of the profile. The opercular apparatus is rounded, and convex upon its margin. Conspicuous scales cover its upper margin as well as the cheeks. On the remaiuing portion of the opercle, and the sub and interopercles, scales are apparently wanting, owing to the transparency of the argentine membrane which passes over them. The branchial apertures are broadly open and continuous under the hyoïdal apparatus. The branchiostegals, six in number, are mostly concealed under the subopercle; the innermost are flattened; the two outermost, small and filiform.

The first dorsal is quite small, and composed of slender rays. The posterior margin of that fin is nearly equidistant between the upper lobe of caudal fin and the extremity of the snout. The second dorsal is of moderate development, with one anterior rudimentary ray, undivided, like the second. The central rays bifurcate twice, with a slight indication of a subdivision of the third degree upon the fourth, fifth, and sixth rays. That fin is a little higher anteriorly than long, with its upper edge concave, and its posterior margin about half the height of the anterior. It is situated immediately opposite the posterior portion of the anal. The base of the anal is much longer than that of the second dorsal, and longer also than the depth of its anterior margin. Its external edge is likewise concave, and its posterior margin about two-fifths the height of the anterior. The first ray is rudimentary; the second is simple; the central ones bifurcate only twice. The caudal is deeply forked with sub-acute lobes. It constitutes the sixth of the entire length. Its central rays bifurcate three times, with partial indications of a subdivision of the fourth degree. The ventrals are altogether situated in advance of the first dorsal; these fins are short and broad exteriorly, when expanded. The anterior ray is the smallest, and remains undivided; the others subdivide three times. The pectorals are of moderate development and acute posteriorly; their ray subdividing but twice, the uppermost remaining simple. They are obliquely inserted below the middle line of the body.

Br. VI; D VI. 11; A 16 + 1; C 3. I. 8. 7. I. 2; V 6; P 15.

The scales are rather small, and subquadrangular in general form; sometimes a little longer than high, at others a little higher than long. They are posteriorly rounded, and subtruncated anteriorly. They constitute more than twenty longitudinal rows upon the line of the greatest depth of the body, and about fifteen rows on the peduncle of the tail. Small and irregular scales may be observed upon the base of the caudal fin. The scales on the cheeks are equal in development to those on the nape. On the opercular pieces they are little larger than on the cheeks. The ground-color is yellowish brown, minutely dotted with blackish. The dorsal region between the silvery bands has a darker hue than the inferior part of the flank, owing to

a great accumulation of dots over the whole surface of the scales, whilst beneath it there is but one series of these dots along the very margin of the scales. The caudal, dorsal, and pectoral fins are greyish yellow; the ventrals and anal are yellowish. The upper surface of head and snout being dark brown.

This species, which is said to inhabit the fresh waters of Chile, was caught by Mr. Darwin in the vicinity of Valparaiso. The specimens before us were collected by Lieut. Gilliss in the Mapocho, an affluent of the Rio de Maypu.

Plate XXX, fig. 6, represents *Basilichthys microlepidotus* in a profile view, and of the size of life.

fig. 7 is an outline, viewed from above.

fig. 8, a scale of the dorsal region.

fig. 9, a scale of the abdominal region.

Figs. 8 and 9 are magnified.

FAMILY OF SILURIDÆ.

Genus NEMATOGENYS, Girard.

Gen. char. Head very much depressed and large. Body posteriorly compressed; posterior margin of caudal fin rounded. Anal opposite space between the dorsal and caudal. Ventrals under the dorsal. Mouth broad, but not deeply cleft; its angle provided with a long barbel. A second pair of subhyoidal barbels shorter than the buccal ones. A still shorter and prenasal barbels constitute a third pair of these appendages. Intermaxillaries and dentaries provided with a patch of card-like teeth. Pharyngobranchials covered with similar asperities. Eyes rather small, situated on the upper surface of head. Opercular apparatus without any spines. Branchial openings continuous under the throat. A spine at the anterior margin of the pectoral fins. Skin scaleless.

Syn. *Nematogenys*, Grd. Proc. Acad. Nat. Sc. Philad. VII, 1854, 198.

Obs. The most prominent characters by which this genus may be distinguished from *Trichomycterus*, consist in the presence of one pair of barbels only at the angle of the mouth, another pair under the head, which is wanting in the latter, and by the absence of prickly or small spines on the opercular apparatus. The absence of an isthmus under the throat may become another not less important point of discrimination between the two genera.

NEMATOGENYS INERMIS, Girard.

Plate XXXII, Figs. 1—3.

Spec. char. Head large and wedge-shaped: snout anteriorly broad and rounded. Origin of ventrals opposite the anterior margin of dorsal. Spiny ray of pectorals prickly beneath. Tip of buccal barbel extending beyond the base of pectorals. Skin beset with minute pustules. Ground-color yellowish brown maculated with white.

Syn. *Trichomycterus inermis*, Guich. in *Gay*, Hist. de Chile, Zool. II, 1848, 312. Ictiol. Lam. ix, fig. 2.

Nematogenys inermis, Grd. Proc. Acad. Nat. Sc. Philad. VII, 1854, 198.

Bagre or *Vagre*. Vernacular.

Desc. The body is elongated, subquadrangular or subrounded upon its anterior half, very much compressed posteriorly, and thinning off towards the base of the caudal fin. The greatest depth, measured in advance of the dorsal fin, is about the eighth of the entire length, whilst the least depth, immediately behind the anal, enters nine times and a half in the same dimension. The greatest thickness, at the origin of the trunk, is equal to the least depth, and the thickness above the anal fin is contained nearly three times and a half in the depth upon that same region. The head constitutes about the fifth of the total length. It is very much depressed, and broader than the body anteriorly. Its depth upon the occipital region is a little less than the half of its length, hence tapering off to the extremity of the snout, being also declive towards the sides. The mouth is broad, though not deeply cleft; the posterior extremity of the upper maxillary reaching a vertical line which would pass a little nearer to the anterior rim of the eye than to the posterior nostril. The jaws are nearly equal, and surrounded with well developed membranous lips, expanding considerably towards the angle of the mouth, where a subcylindrical barbel is observed, which extends posteriorly beyond the base of the pectoral fins. A pair of flattened barbels may be observed under the head, attached to the anterior part of the hyoidal apparatus, each widely separated from one another. When stretched backwards in a straight line from their insertion, their tip reaches the edge of the branchiostegal membrane. The nostrils, right and left, are wide apart; the anterior is much the largest, situated close to the jaw, and provided at its upper and posterior rim with a flattened and tapering barbel about seven twentieths of an inch long, immediately behind which may be seen the posterior opening, subcircular in shape, and provided upon its upper and posterior rim with a membranous expansion sufficiently large to cover that aperture when let down upon it. The eyes, situated towards the upper surface of the head, are small, inconspicuous, and elongated; their longitudinal diameter measuring but a quarter of an inch; their posterior rim being nearly equidistant between the margin of the upper jaw and the posterior edge of the opercular apparatus. An oblong and rather large patch of card-like teeth exists upon the intermaxillaries; the upper maxillaries being toothless. A broad band, posteriorly tapering, of similar but smaller teeth, may likewise be seen upon the dentary or lower jaw. The roof of the mouth is smooth; but at the entrance of the esophagus the pharyngobranchials, upper and lower, are possessed with teeth of the same description, but smaller still than those of the dentaries, becoming almost velvet-like. The upper pharyngobranchials are subelliptical in shape and convex, whilst the inferior pair of these bones are subtriangularly elongated and subconcave. A double row of conical processi are observed, one upon each side of the branchial arches; the anterior row more developed than the posterior one. The tongue is short, and provided on each side with a fleshy expansion. The opercular apparatus is concealed under the skin, without either spines or serratures of any kind. The branchial apertures are broadly open, and split to the hyoidal apparatus, without any intermediate membrane connecting the right and left flaps. The branchiostegals are numerous and slender; those next to the opercular apparatus are flattened, the others circular—all more or less curved. The membrane which unites them extends beyond their tips.

The anterior margin of the dorsal fin is nearly equidistant between the extremity of the snout and the base of caudal. That fin is higher than long, superiorly convex; its central rays are subdivided three times. The anal resembles the dorsal in general appearance, being deeper than long, but more acuminated posteriorly. Its central rays bifurcate, likewise, thrice, and their tips reach the rudimentary rays of the caudal, between the base of which and the origin of ventral its anterior margin corresponds. The caudal, which constitutes a little less than the sixth of the entire length, is broad and rounded posteriorly; its central rays bifurcate three times upon their length; there are numerous rudimentary rays above and below. The insertion of the ventrals is nearly opposite to the anterior margin of the dorsal. These fins are of medium size, exteriorly rounded when expanded, and their rays three times bifurcated. The pectorals are longer and narrower than the ventrals, and inserted near the inferior surface of the body;

their anterior edge being placed a little in advance of the posterior expansion of the opercle. The spine which occupies this region is well developed, provided with minute prickles beneath, and with a series of small, subtriangular serratures posteriorly. Its tip is continued to the margin of the fin under the form of a membranous ray. The soft and articulated rays are bifurcated three times. The external margin of these fins is rounded when expanded.

Br. XII; D 10; A 11; C 16. I. 7. 7. I. 12; V 6; P I. 7.

The anterior ray of both the dorsal and anal fins is small and slender, and the second shorter than the third, which is a little longer than the last of all.

The skin is densely studded with minute pustules, smooth to the touch, and extending to all the regions, except the lower surface of the head, throat, and belly. The lateral line, from the opercular apparatus, runs almost straight along the middle of the flanks to the base of caudal fin, undergoing but a very slight inflexion downwards upon the thoracic region. It is much more conspicuous anterior to the dorsal fin than farther back, where it exists under the shape of small pores.

The ground-color is reddish, or yellowish brown. The upper surface of head is nearly black; numerous blackish and rounded spots or blotches are spread all over the body and sides of the head, with a tendency towards longitudinal series along the flanks and tail; the blotches often being confluent, and inconspicuously defined. On the fins, these spots assume a transverse arrangement, and give to the latter an irregularly banded or barred appearance. The inferior surface of the head and belly are whitish, the former regions sometimes maculated. The buccal and prenasal barbels are black; the subhyoidal ones whitish, or semi-blackish. The ventrals and pectorals are lighter beneath than above.

Specimens of this species were collected in an affluent of the Rio de Maypu, in the vicinity of Santiago. According to Mr. Gay, it is to be found in the fresh waters throughout the republic of Chile.

Plate XXXII, fig. 1, represents *Nematogenys inermis* in a profile view, and nearly the size of life.
fig. 2, is an outline of the fish seen from above, to show the disposition of the eyes, nostrils, and prenasal barbels.
fig. 3, is a view of the inferior surface of the head, exhibiting the insertion of the subhyoidal barbels, the continuity of the branchial aperture with the hyoidal apparatus, and the branchiostegal rays.

Genus THRICHOMYCTERUS, (Humb.) Valenc.

Gen. char. Head depressed and rather small. Body anteriorly rounded; posteriorly compressed. Caudal fin emarginated or subemarginated. Anal under the posterior part of dorsal, and ventrals in advance of the latter. Mouth small, or of medium size, inferior, and provided with a double pair of barbels at its angle. No barbels under the head. One pair of prenasal barbels. Velvet-like teeth upon the intermaxillaries and lower jaw. Palate smooth. Eyes very small, situated on the upper surface of the head. Opercular apparatus prickly. Branchial openings not continuous under the throat. Fins without any spiny rays. Skin scaleless and smooth.

Syn. *Thrichomycterus* (Humb.), Valenc. in *Humb.* Rec. d'Obs. de Zool. et d'Anat. comp. II, 1833, 347.
Cuv. et Val. Hist. Nat. Poiss. XVIII, 1846, 485.
Guich. in *Gay*, Hist. de Chile, Zool. II, 1848, 309.
Girard, in Proc. Acad. Nat. Sc. Philad. VI, 1854, 198.

Obs. The name of *Thrichomycterus* was first framed by Humboldt,* under the following circumstances: Having obtained a fish from the Rio Bogota, in New Grenada, he published a memoir thereon, in which he says: "Je l'ai nommé *érémophile*, à cause de la solitude dans laquelle il vit à de si grandes hauteurs, et dans des eaux qui ne sont presque habitées par aucun être vivant. Les naturalistes qui craignent que de nouvelles espèces de ce même genre ne viennent à être découvertes dans des situations très-différentes, pourraient changer le nom d'*érémophile* en celui de *thrichomycterus*, tiré des barbillons attachés au nez de ce poisson."

Thrichomycterus, therefore, in the estimation of Humboldt, was exactly the synonym of *Eremophilus*.

Now, in the second volume of the same work, Valenciennes, after giving us a more complete description of *Eremophilus mutisii*, mentions that another fish, generically distinct from the above, had been obtained from Brazil, and for which he would propose the name of *Thrichomycterus*, imagined by Humboldt.

No reference to the history of this generic name being made in the *Histoire Naturelle des Poissons*, we have considered ourselves fully justified in relating it here. The transfer of a name to a thing for which it was not originally intended, if not explained, is liable to throw a great deal of confusion upon the subject it refers to, and is likewise an infraction to sound rules of nomenclature.

Many species having been described under the name of *Thrichomycterus*, we would advise that it should be retained, rather than to frame another one. The species of *Thrichomycterus* are closely allied to *Eremophilus*, from which they chiefly differ by the presence of ventral fins.

THRICHOMYCTERUS MACULATUS, Cuv. et Val.

Plate XXXIV, Figs. 1—3.

Spec. char. Head small and very depressed, declive towards the snout, which is anteriorly rounded. Mouth small. Maxillary teeth inconspicuous. Upper buccal barbel longer than the lower, neither of which reaching the base of pectorals. Prenasal barbel as long as the upper buccal. Opercle and subopercle prickly. Isthmus quite small. Branchiostegals, six. Caudal submarginated posteriorly. Skin perfectly smooth. Ground-color yellowish or brownish, maculated with black. Fins greyish yellow.

Syn. *Thrichomycterus maculatus*, Cuv. et Val. Hist. Nat. Poiss. XVIII, 1846, 493.
Guich. in *Gay*, Hist. de Chile, Zool. II, 1848, 311.
Girard, in Proc. Acad. Nat. Sc. Philad. VI, 1854, 199.
Bagre, or *Vagre*. Vernacular.

Desc. The species is one of small size. The body is slender and elongated, anteriorly rounded, and slightly compressed; posteriorly more so. The greatest depth, measured immediately behind the tip of pectoral fins, is contained nearly nine times in the total length, and the least depth, taken on the peduncle of the tail, enters in that same length thirteen times. The greatest thickness, at the anterior portion of the body, is about equal to the depth. The head is contained six times and a half in the total length. It is much depressed, wedge-shaped, and equally declive towards the sides. The snout is anteriorly rounded. The upper jaw overlaps the lower, thus giving the mouth an inferior situation. The latter is small, and surrounded with thick and fleshy lips, but little extensible upon the upper jaw. A membranous expansion is to be observed at the angle of the mouth, immediately below the barbels. The latter are

* Recueil d'Observations de Zoologie et d'Anatomie Comparée, &c, Vol. I, 1811, 18.

flattened, thick at their base, and filiform towards their extremity. The upper one is a little longer than the lower, its tip extending to the posterior edge of the opercular apparatus, when stretched straightway backwards. The velvet-like teeth constitute an elongated and transverse patch upon the intermaxillaries. A similar area of similar teeth exists upon the symphysis of the dentaries, or lower jaw. The palate is perfectly smooth. The pharyngobranchials, upper and lower, are either smooth or provided with very inconspicuous prickles: as far as we could ascertain, they appeared to be smooth. The anterior nostril approximates the upper jaw, and is provided at its external edge with a flattened (at base) and filiform (at tip) barbel, and about as long as the upper buccal. The posterior nostril, situated a little behind the anterior, is a little larger than the latter, and provided anteriorly with a very low and thin membrane. The eyes, which are situated towards the upper surface of the head, and far apart, are very small and somewhat elongated, nearly equidistant between the margin of the upper jaw and the posterior edge of the opercular apparatus. The cheeks are smooth, like the upper surface of the head, and the opercular apparatus concealed under the skin exhibits only a small group of prickles, situated at the upper angle of the opercle. The subopercle is largely developed, and its surface is covered with very conspicuous club-shaped prickles. The branchiostegal rays are entirely concealed under the subopercle. They are six in number; the four innermost flattened—all being enclosed in a tough membrane which projects beyond their tips. The branchial apertures are continuous, but not split under the hyoidal apparatus. The dorsal fin is situated far back; its anterior margin being much nearer to the posterior extremity of the caudal than to the tip of the snout. It is nearly as high anteriorly as its base is long; the height of its posterior margin is less than the half of the anterior margin. Its upper margin is subconvex. The origin of the anal is situated opposite the posterior third of dorsal. It is nearly twice as deep as the extend of its base, and exteriorly convex. The tips of its central rays consequently extend farther backwards than those of the dorsal, without, however, reaching the base of the caudal. The latter constitutes about the eighth of the entire length. It is posteriorly subemarginated, with its lobes rounded. There are numerous rudimentary rays which contribute to give to the extremity of the peduncle of the tail a dilated appearance. The ventrals are situated in advance of the dorsal; their posterior extremity reaching a vertical line which would pass immediately in advance of the anterior margin of the last mentioned fin. The ventrals themselves are small and convex exteriorly, their tips not reaching the vent, which is situated somewhat in advance of the anterior margin of the anal fin. The pectorals are likewise short, broad, and rounded exteriorly, their insertion being almost horizontal, and below the middle line of the body.

Br. VI; D 13; A 8; C 10. I. 6. 5. I. 9; V 5; P 9.

The anterior three rays of both the dorsal and anal fins are simple and shorter than the fourth, the first being quite rudimentary. The anterior ray of the ventrals and pectorals is simple also, and enclosed in a thick membrane. The central rays of all the fins are bifurcated three times upon their length. The lateral line is very inconspicuous, and visible only upon the anterior third of the body, where distant pores may be followed from the upper part of the opercle towards the middle of the flanks, after a slight convexity upwards at its origin. The skin is otherwise perfectly smooth. It is needless to add that a thick layer of mucosity covers the whole body, the head, and the fins.

The ground-color is either yellowish or brownish, with small purplish maculæ spread all over the head, where they assume a cloudy aspect; also over the body, along the sides of which obsolete longitudinal stripes are to be seen. Two other stripes, more indistinct still, along the dorsal line, from nape to origin of dorsal; and three along the sides, the middle one of which running along the middle region of the body and tail. The inferior surface of the head and the belly are of a soiled yellow hue. The barbels and the fins are greyish yellow.

Specimens were caught in the Rio Mapocho, near Santiago.

Plate XXXIV, fig. 1, represents *Thrichomycterus maculatus*, size of life, and in profile.
fig. 2 is an outline of the same, seen from above.
fig. 3, the head, seen from below.

THRICHOMYCTERUS MACRÆI, Girard.

Spec. char. General aspect elongated, subfusiform; peduncle of tail long and slender. Dorsal fin elongated, and quite low posteriorly. Anal fin narrow. Ventrals and pectorals rather small. Caudal posteriorly emarginated. Ground-color greenish brown, with small, pavement-like blackish spots extending all over the body.

Descr. The general form resembles that of *T. maculatus;* the peduncle of the tail is still more slender, and the posterior edge of the caudal subcrescentic, with the inferior lobe larger than the upper lobe. The head is contained nearly six times and a half in the total length, which measures four inches and a half. The base of the dorsal fin is contained three times in the distance between its anterior margin and the extremity of the snout, and once between its posterior margin and the base of the caudal; the latter fin being one fourth shorter. The anterior third of said dorsal fin is higher than the remaining portion, which is comparatively very low. The origin of the anal takes place opposite the middle of the length of the dorsal; it is deeper than long, and rounded upon its external margin, which extends backwards almost evenly with the posterior margin of the dorsal. The ventrals and pectorals are short and rounded exteriorly. The buccal and nasal tentacles are shorter than in *T. maculatus*. The prickles about the opercular apparatus are but little conspicuous. The head is broad and depressed; the mouth is moderately developed.

The ground-color is greenish or yellowish brown; the upper regions are covered with numerous small blackish spots, assuming a tessellated or else a pavement-like aspect. Beneath, the color is uniform yellowish or greyish. The fins present the same tint, with a blackish hue towards their margin.

Three specimens of this species were collected by Lieutenant MacRae near Uspullata, east side of the cordilleras, at an elevation of about 7,000 feet.

FAMILY OF CLUPEIDÆ.

Genus ALOSA, Cuv.

Gen. char. No teeth upon any of the bones constituting the apparatus of the mouth.

Syn. *Alosa*, Cuv. Règn. Anim. (2d ed.) II, 1829.
Cuv. et Val. Hist. Nat. des Poiss. XX, 1847, 389.

Obs. The total absence of teeth in this genus will readily distinguish it from any other of the same family. It is here admitted as characterized in the "Histoire Naturelle des Poissons." The species resemble the herrings in their general appearance; the stomach being rather large and acute, and the pylorus provided with numerous cœca. The intestine likewise folds twice upon itself. The air-bladder is large, attenuated at both extremities, swollen upon its middle region, and communicating with the stomach; its anterior extremity not extending beyond the third vertebra.

ALOSA MUSICA, Girard.

PLATE XXXI, Figs. 1—4.

SPEC. CHAR. Body subfusiform, elongated, compressed, and tapering posteriorly. Origin of ventrals opposite the middle region of dorsal. Posterior extremity of upper maxillary reaching the vertical of anterior rim of pupil. Lower jaw longest. Back bluish; sides silvery. A series from nine to eleven roundish spots along the sides.

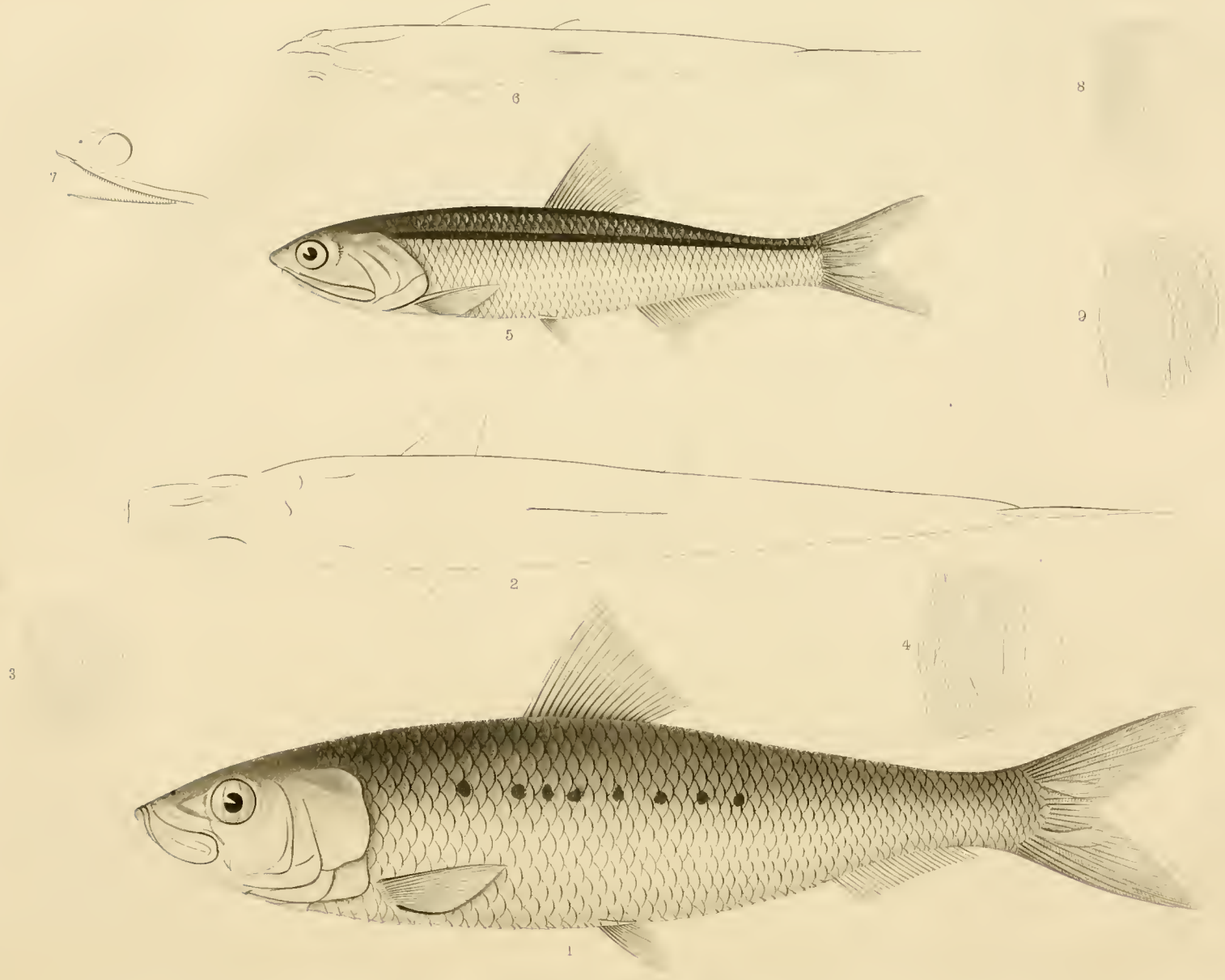
SYN. *Alosa musica*, GRD. Proc. Acad. Nat. Sc. Philad. VII, 1854, 199.

DESCR. The body is elongated, subfusiform in its profile, tapering considerably on the peduncle of the tail. The greatest depth, measured immediately in advance of the anterior margin of the dorsal fin, is a little less than the fifth of the entire length, whilst the least depth, near the base of the caudal, is about the third of the former. The greatest thickness, on the thoracic region, is equal to half the greatest depth. The dorsal and abdominal outlines are very regular and but moderately convex. The head, which forms about the fourth of the total length, continues uniformly towards the outlines just mentioned, in the shape of an acute triangle, rounded upon its summit, where the mouth opens, with a lower jaw somewhat longer than the upper; the latter is but slightly notched. Its upper surface is flattened. The upper maxillary is broadly dilated, and rounded posteriorly, where it reaches a vertical line which would intersect the anterior rim of the pupil. The nostrils are small, and nearer to the tip of upper jaw than to the anterior rim of the eye. The anterior one is rounded, whilst the posterior one is subcrescentic and convex posteriorly. The eye is large and circular, and approximates the upper profile of the head; its diameter being contained about four times and a half in the length of the side of the head. The opercular apparatus is posteriorly subtruncated and undulated; the upper part of the opercle exhibits small, radiating grooves, whilst oblique and rectilinear striæ are observed along the anterior half of its lower part. The other opercular pieces are smooth. The branchiostegals, six in number, are very thin and flattened; the innermost is particularly expanded and notched upon its posterior and external margin, corresponding to a similar emargination of the inferior edge of the opercular apparatus at the junction of the sub and interopercles.

The anterior margin of the dorsal fin is nearer to the tip of snout than to the base of caudal fin. It is higher anteriorly than long, with its first three rays rudimentary and simple, like the fourth, which is the highest; the posterior margin of that fin is comparatively low, having but the third of the height of the anterior margin. Its upper margin is concave. The central rays are bifurcated twice, the first subdivision taking place upon the posterior third of their length. The anal is situated far back, is very low, and subconcave exteriorly; its base is a little longer than that of the dorsal, and its anterior margin less deep than half the height of the anterior margin of the dorsal. The second, third, and fourth rays are the longest, and remain simple, as well as the first. The central rays subdivide but once. The caudal fin is deeply forked, and its lobes are acute, constituting about the sixth of the total length, its central rays bifurcating three times upon their length. The origin of the ventrals is situated opposite the middle of length of dorsal. These fins are of moderate development, and posteriorly subtruncated, their tips projecting slightly beyond the longest rays of the dorsal. The pectorals are well developed, of a rather slender appearance when contracted, and very broad exteriorly when expanded. They are inserted immediately beneath the subopercle; their external margin is twice and a half as long as the internal, their posterior edge being rounded and subconcave. The central rays bifurcate three times, as do also those of the ventral fins.

Br. VI: D 19 + 1; A 16 + 1; C 5. I. 9. 8. I. 4; V 8; P 17.

The anterior ray of both ventral and pectoral fins is simple, but articulated.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The scales are large, and nearly as long as deep, irregularly subtruncated anteriorly, rounded and convex upon their anterior margin, which is minutely serrated. They are nowhere sufficiently preserved upon the specimens before us to allow an enumeration of the longitudinal rows.

The upper part of the head and dorsal region are of a uniform bluish slate hue. The sides of the head and body are silvery, with a bluish reflexion. Nine to eleven bluish black and subcircular or subelliptical spots are observed, forming a series from the upper part of the thoracic belt to half-way between the posterior extremity of the caudal and the origin of the anal. These spots are mostly situated upon the upper margin of the silvery portion of the sides of the body, a circumstance which gives to them a very conspicuous appearance. The fins are yellowish; the dorsal and caudal, mayhap also the anal, being transversally strigated with greyish.

From Caldera bay; caught in the winter months. This is the fish, referred to in the narrative, (page 270–271,) which, in the opinion of the inhabitants of that locality, emits melodious sounds as they enter the harbor. Without giving any more credit to that popular belief than it really deserves, we have designated this species under the above appellation.

Plate XXXI, fig. 1, represents *Alosa musica* in a profile view, size of life.
fig. 2, is an outline, viewed from above.
fig. 3, a scale from the dorsal region.
fig. 4, a scale from the abdominal region.
Figs. 3 and 4 are magnified.

Genus ENGRAULIS, Cuv.

Gen. char. Body rounded or compressed. Mouth large; snout protruded beyond the lower jaw. Intermaxillaries very small, and hidden under the snout. Maxillaries slender, stretching over the cheeks. A few teeth on front of vomer. Palatine and pterygoidian teeth sometimes reduced to mere asperities. Gill openings very large and continuous under the throat. Branchiostegal membrane narrow and hidden under the jaw; its rays being short and variable in number. Caudal fin forked. Dorsal fin rather small. Insertion of pectorals near the gill openings. Ventrals very small.

Syn. *Engraulis*, Cuv. Règn. Anim. II, 1817.
Cuv. and Val. Hist. Nat. Poiss. XXI, 1848, 2.

Obs. The peculiar structure of the snout, as well as the shape of the mouth, will strike every one as the most characteristic feature of the small Clupeoid which constitutes this genus. The head, which is very elongated in some species, is short in others.

ENGRAULIS PULCHELLUS, Girard.

Plate XXXI, Figs. 5—9.

Spec. char. Body subfusiform, slender, and compressed. Origin of ventrals situated in advance of anterior margin of dorsal. Vent immediately opposite the hind margin of same fin. Scales higher than long. Dorsal region purplish. Sides of head and body silvery.

Syn. *Engraulis pulchellus*, Grd. Proc. Acad. Nat. Sc. Philad. VII, 1854, 199.

Descr. The head constitutes about one fourth of the entire length, and is in direct continuity with the trunk, being slightly declive from the occipital region towards the tip of the snout, which has the shape of a flattened cone. The anterior margin of the anterior nostril opening is nearly equidistant between the tip of snout and the anterior rim of the orbit; the posterior nostril opening is situated immediately behind the former; both being rather small and of the same development. The eye is large and subcircular, its upper rim approximating the line of the profile of the head. Its horizontal diameter is contained a little over four times in the length of the side of the head, and once between the tip of the snout and the anterior rim of the pupil. The extremity of the lower jaw does not extend beyond a vertical line, which would pass immediately in advance of the anterior nostril. The posterior extremity of the upper maxillary reaches the extremity of the preopercular carina: not the posterior limb of that bone. The intermaxillaries, the maxillaries upon the whole extent of their margin, and the dentaries, are minutely crenated, not to say serrated, or toothed. The middle lingual carina is quite conspicuous, and obsoletely crenated also. The posterior edge of the opercular apparatus is convex, and subelliptically rounded. Its component pieces are smooth, except the upper portion of the opercle, which exhibits a few minute carinæ. The preopercle sends off a thin expansion of its limb over the junction of the opercle, subopercle, and interopercle. The gill openings are broadly open under the head, extending forwards almost opposite to the anterior rim of the pupil.

The body is slender, subfusiform, and compressed; deepest anteriorly, and gradually tapering posteriorly in depth and width. The greatest depth, taken across the base of the pectoral fins, is contained over six times and a half in the total length; whilst the least depth, near the base of the caudal fin, is scarcely half the latter. The greatest thickness, upon the thoracic region, is a little more considerable than the least depth. The peduncle of the tail is flattened, and wedge-shaped towards the base of the caudal fin. The back is uniformly rounded or convex, and the ventral region narrow. The anterior margin of the dorsal fin is equi-distant between the tip of the snout and the base of the caudal; its anterior margin is equal in height to its base, and its posterior margin is about one fourth of the anterior margin. Its upper margin is slightly subconcave. The origin of the anal is opposite the tips of the posterior rays of the dorsal. Its base is one fourth longer than that of the dorsal, and its anterior margin about the three fourths of its base. It is concave upon its external margin, and rapidly decreasing in depth beyond the anterior third of its length. The rays of the dorsal and anal subdivide but once upon the posterior third of their length. The caudal is slender and deeply forked, constituting a little less than one seventh of the total length; its central rays are subdivided three times with obsolete indications upon their tip of a subdivision of the fourth degree. The ventrals are rather short, broad exteriorly when expanded, and rounded or convex upon their margin; their central rays subdividing twice. Their origin is situated in advance of the anterior margin of dorsal, and their tips extend slightly beyond the middle of the base of the same fin. The pectorals are rather slender, and attached to the inferior part of the thoracic region; their external margin is much longer than the internal, and moderately broad when expanded. Their central rays bifurcate twice upon their length; the anterior one being simple, as well as that of the ventrals.

Br. IX; D 16; A 17; C 3. I. 9. 8. I. 3; V 7; P 16.

The anterior two rays of the dorsal and anal fins are simple, the first being but little developed.

The scales are very large, much deeper than long, irregularly rounded, convex posteriorly, and undulated anteriorly. Five longitudinal rows may be counted immediately above the posterior extremity of the anal fin, and perhaps six or seven rows upon the line of greatest depth of the body.

The lateral line is not discernible.

2
3
1

The dorsal region is yellowish, covered with numerous purplish dots, so crowded on the middle line of the back, and along the argentine surface of the flanks, as to appear upon these regions like purplish vittæ. The flanks are uniformly silvery; the upper limits of the argentine surface running straight from the upper part of opercle to near the origin of the upper part of the base of the caudal fin. The opercular apparatus and sides of head are silvery like the flanks. The fins are yellowish, the rays of the dorsal and caudal fins alternately spotted greyish or blackish.

Specimens of this species were caught in Caldera bay, in the month of July.

Plate XXXI, fig. 5, represents *Engraulis pulchellus* in profile, and size of life.
fig. 6, is an outline, viewed from above.
fig. 7, the head enlarged.
fig. 8, a scale from the dorsal region.
fig. 9, a scale from the abdominal region.

Figs. 8 and 9 are magnified.

FAMILY OF CHARACINI.

Genus CHEIRODON, Girard.

Gen. char. Body compressed; abdomen not serrated. Adipose fin present. Teeth upon the maxillary, the intermaxillary, and the dentary disposed upon a single series along both jaws, and dilated towards their edge, which exhibits generally five acute points. No canine. Palate without teeth. Scales large. Gill openings large. Branchiostegal rays, three in number. Pharyngeal teeth velvet-like, very minute. Dorsal fin situated between the ventrals and the anal.

Syn. *Cheirodon*, Grd. Proc. Acad. Nat. Sc. Philad. VII, 1854, 199.

Obs. The form of the teeth bears a general resemblance to those of *Astyanax*, but it will be remembered that in the last genus they are disposed in a double row on both the upper and lower jaws. The dorsal fin in *Cheirodon* is placed opposite the space between the ventrals and anal, whilst in *Astyanax* it is situated above the ventrals.

CHEIRODON PISCICULUS, Girard.

Plate XXXIV, Figs. 4—7.

Spec. char. Snout short and rounded; eye rather large. Maxillary teeth very small and few. Dorsal fin higher than long. Caudal forked. Anal nearly as deep as long. Ventrals and pectorals slender. Scales proportionally very large, higher than long. A silvery band along the middle of the flanks, margined above with black. Fins unicolor, olivaceous.

Syn. *Cheirodon pisciculus*, Grd. Proc. Acad. Nat. Sc. Philad. VII, 1854, 199.

Descr. A small fish of a rather short appearance, in spite of the slenderness of the peduncle of the tail. The dorsal and ventral lines are equally arched, forming two opposite curves, embracing the head in a uniform outline. Thus the general profile has more of a subelliptical than subfusiform aspect. The body is very much compressed. The greatest depth, measured just above the insertion of the ventrals, is contained from three to four times in the total length;

whilst the least depth, on the peduncle of the tail, is but two-fifths of the greatest. The greatest thickness is about one half of the greatest depth. The head is short, compressed like the body, and rounded upon its anterior outline. It constitutes about one fifth of the entire length. The nostrils are very much developed, placed towards the upper surface of the head, and nearer to the anterior rim of the eye than to the extremity of the upper jaw. The anterior opening is subcircular; the posterior one, subcrescentic. The eye is large and circular; its diameter is contained about three times in the length of the side of the head, and less than once in advance of its anterior rim. The mouth is small and slightly oblique; the posterior extremity of the upper maxillary extending to a vertical line which would pass immediately in advance of the anterior rim of the eye when the mouth is closed. There is one row of teeth upon each jaw; on the dentary the teeth are much larger than on the intermaxillaries. Their form is flattened, dilated towards their upper edges, which are provided generally with five subconical points, the middle one being the longest, giving them the appearance of a digit. The palate is perfectly smooth, and unprovided with teeth. The opercular apparatus is very much developed, and subconvex upon its outer edge. The sub and interopercles are quite large, and occupy a prominent place. The opercle is narrow above, expanded below, and slightly convex posteriorly. The subopercle is curved, and in an oblique situation, with reference to the orientation of the head. The gill openings are continuous under the hyoidal apparatus; the branchiostegals, three in number, are well developed, curved and flattened, the outermost being but a little smaller and more slender than the innermost, or next to the opercular apparatus.

The anterior margin of the dorsal fin is nearer to the extremity of the snout than to the tip of the caudal fin; it is much higher than long; its upper edge is rounded or subconvex. The rays bifurcate but once, and this for more than the half of their length. The anterior ray is rudimentary, the second undivided. The adipose is slender, nearer to the base of the caudal than to the posterior edge of the dorsal, and consequently situated behind the anal. The anal is longer than the dorsal, and nearly as long as it is deep; its exterior edge, convex anteriorly, is subconvex posteriorly. Its anterior margin is situated backwards of the posterior edge of the dorsal. There are very slight indications of a bifurcation of the second degree upon the tip of its central rays; the first being rudimentary, and the second simple or undivided, as is the case in the dorsal. The caudal fin, which constitutes about one fifth of the total length, is deeply forked posteriorly; its lobes are rather rounded, and acute only upon their extremity. The central rays, towards their extremity, exhibit a subdivision of the third degree. The insertion of the ventrals takes place upon the middle of the abdomen, somewhat in advance of the anterior margin of the dorsal. These fins are rather slender, with their tips acute, and reaching the vent. Their central rays bifurcate twice. The origin of the pectorals is situated near the inferior region of the thoracic belt. These fins are longer and more slender than the ventrals; their tip almost reaching the origin of the latter fins. Their anterior ray is simple; the central ones are but once bifurcated, and only towards the last third of their length.

Br. III; D 10. 0; A 14; C 3. I. 9. 8. I. 2; V 7; P 11.

The scales are of moderate development, higher than long, subelliptical in shape, sometimes very irregularly so. Ten or eleven longitudinal rows may be counted upon the line of the greatest depth, and six or seven rows upon the peduncle of the tail. The lateral line is not to be seen.

The ground-color is olivaceous brown, with a silver band along the middle of the flanks, extending from the upper angle of the opercular apparatus to the base of the caudal fin. The cheeks, the opercles, and branchiostegal apparatus are silvery. A blackish stripe may be traced all along the upper edge of the silvery band of the sides. The dorsal region is minutely dotted with blackish, the dots being more particularly crowded upon the outline of the scales. These dots extend to the upper surface of the head, and sparingly to the upper region of the thoracic and abdominal regions; also to the inferior half of the peduncle of the tail. The dorsal, cau-

dal, and anal fins are almost greyish, through the accumulation of the above mentioned dots. The ventrals are unicolor; the pectorals greyish upon their external margin. The abdominal region sometimes exhibits an argentine reflection.

Inhabits the lagoons in the vicinity of Santiago, Chile.

Plate XXXIV, fig. 4, represents the profile of *Cheirodon pisciculus*, size of life.
fig. 5, is a scale from the dorsal region.
fig. 6, a scale from the lateral line.
fig. 7, a scale from the abdominal region.
Figs. 5, 6, and 7 are magnified.

FAMILY OF MYXINOIDEA.

Genus BDELLOSTOMA, Müll.

Gen. char. Body eel-shaped. Anterior portion of head provided with four pairs of tentacles. Eyes small. One hook-like tooth on the middle of the palate; a double and arched series of teeth upon the tongue. External branchial apertures from six to fourteen, corresponding to as many gills, which are situated far behind the head.

Syn. *Bdellostoma*, Müll. Abhand. Akad. Wis. Berl. (1834) 1836, 79, and (1838) 1839, 173.
Heptatrema, Dum. Zool. Anal. 1806.

Obs. We refer naturalists to the memoir on the "Comparative Anatomy of the Myxinoids," published in the Transactions of the Academy of Berlin for the years 1834 and 1838, for information upon the internal structure of the fishes constituting the present genus. The species which is described below might have furnished some interesting anatomical facts had the specimen been in a better state of keeping. There are fourteen pairs of gills, seven more than in either of the species previously known.

The description of a Chilean species under a new specific name may well raise the question as to whether we had not before us the *Gastrobranchus dombeyi* of Lacépède (*Bdellostoma dombeyi*, Müll.), of which very little is known up to the present time. Lacépède's description was drawn from a dried specimen, no mention being made as to the number of respiratory apertures. The anterior row of hyoidian teeth is composed of eleven teeth on each side, and the posterior row of seven only, whilst in the one here described there are twelve teeth, on either side, in both rows. Moreover, as the eyes are said to be wanting in the species referred to by the French ichthyologist, we did not feel justified in attempting, for the present, its identification, since the absence of the organs of vision would even remove it from the genus *Bdellostoma*.

It is to be regretted that Duméril's appellation of *Heptatrema*, by referring to a point of organic structure subjected to variations, could not be retained to designate these fishes generically. If that name be restricted to the species provided with seven respiratory apertures, then each species would constitute a genus by itself; that with six of these apertures ought accordingly be called *Hexatrema;* then *Heterotrema* when six are observed on one side and seven on the other; *Heptatrema* when seven; and finally *Polytrema* for the species described farther on.

Considering, however, the structure of the mouth, both internally and externally, we would not hesitate in uniting them all under the well appropriated name of *Bdellostoma*, suggested by Prof. Müller.

BDELLOSTOMA POLYTREMA, Girard.

PLATE XXXIII, Figs. 1—5.

SPEC. CHAR. Fourteen respiratory apertures and gills on either side. Twelve teeth on either side in the posterior as well as in the anterior row. Eyes present. Color not preserved in the specimen described.

SYN. *Bdellostoma polytrema*, GRD. Proc. Acad. Nat. Sc. Philad. VII, 1854, 199.

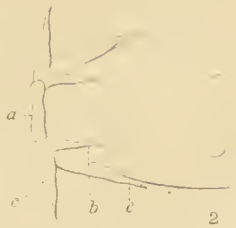
OBS. In the second part of his memoir on the "Comparative Anatomy of the Myxinoids," Prof. Müller is inclined to believe that all the species enumerated in the first part, and which came to his knowledge, are but simple varieties of *Bdellostoma forsteri* (*Petromyzon cirrhatus* of Forster), an inhabitant of Queen Charlotte's bay, New-Zealand. This would give a remarkable geographic range to that species, as it is well known that *Bd. hexatrema* and *Bd. heterotrema*, both, inhabit the Cape of Good Hope; *Bd. dombeyi* the coast of Chile, and *Bd. heptatrema* the southern seas. The latter is more closely allied to *Bd. forsteri* than any other, and its locality in the southern seas may after all prove not to be far from New-Zealand.

Since *Bd. polytrema* has come to light, bearing in itself the remarkable fact of having fourteen pairs of gills, instead of six and seven, which are the usual number in the species previously known, we deem it advisable to retain them all as provisionally distinct. Moreover, the genus would not be limited to the austral hemisphere, for we find mentioned, in the "Fauna Japonica," p. 310, a species under the name of *Heptatrema cirrhatum*, which is another *Bdellostoma* (*Bd. burgeri*), judging of it by the figure given on Plate CXLIII, which exhibits a similar aspect of the head, the same shape of the mouth and cephalic tentacles. The eyes appear to be very small. A singular circumstance is mentioned by Mr. Bürger, by whom it was collected, and who states that during the summer months these fishes, generally a foot and some inches long, are caught in great numbers on muddy bottoms in the Bay of Simabara, at some distance from Nagasaki, and that the Japanese usually eat them raw. This latter species is more slender than the one of which we give a figure and a description.

DESCR. *Bdellostoma polytrema* is about fifteen and a half inches long. The body is subcylindrical anteriorly and compressed posteriorly, particularly upon the tail, which constitutes a little less than one sixth of the entire length. The head is slightly tapering towards the snout. The nasal opening (*a*) which terminates its anterior extremity, is transversally elliptical and very large, provided on each side with two tentacles; the uppermost (*b*) is the smallest and directed upwards; the other, (*c*), a little longer, stretches laterally outwards. Underneath the head we find the mouth (*d*), longitudinally subovoid, beset with minute cirrhi around its external margin. A broad and flattened tentacle (*f*), directed inwardly, may be seen extending over the buccal aperture across the middle of its longitudinal diameter. Another slender and second pair of buccal tentacles (*e*) is inserted near the base and external margin of the latter flattened pair, stretching outwardly backwards.

The tongue (fig. 5) is subcordiform, bearing two arched series of subconical teeth obliquely directed backwards. The posterior series is composed of considerably smaller teeth than the anterior one. In both there are twelve teeth on either side. A tooth from each series is represented isolated (*a*) on the right side of figure 5. To the left (*b*) may be seen the hook-like palatine tooth, subconical in shape, and likewise directed backwards.

The eyes are not very conspicuous, and are situated at about eight tenths of an inch from the extremity of the snout. A series of mucous pores may be seen extending below the middle of the sides, from near the anterior part of the body to near the extremity of the tail. The six or seven anterior holes are much larger than the remaining ones, which diminish backwards, becoming almost minute along the caudal region. The respiratory apertures are situated immediately above the series just alluded to, and may easily be distinguished by their larger size.



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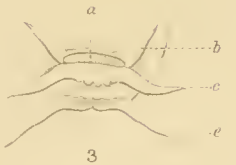

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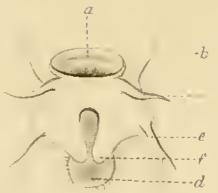

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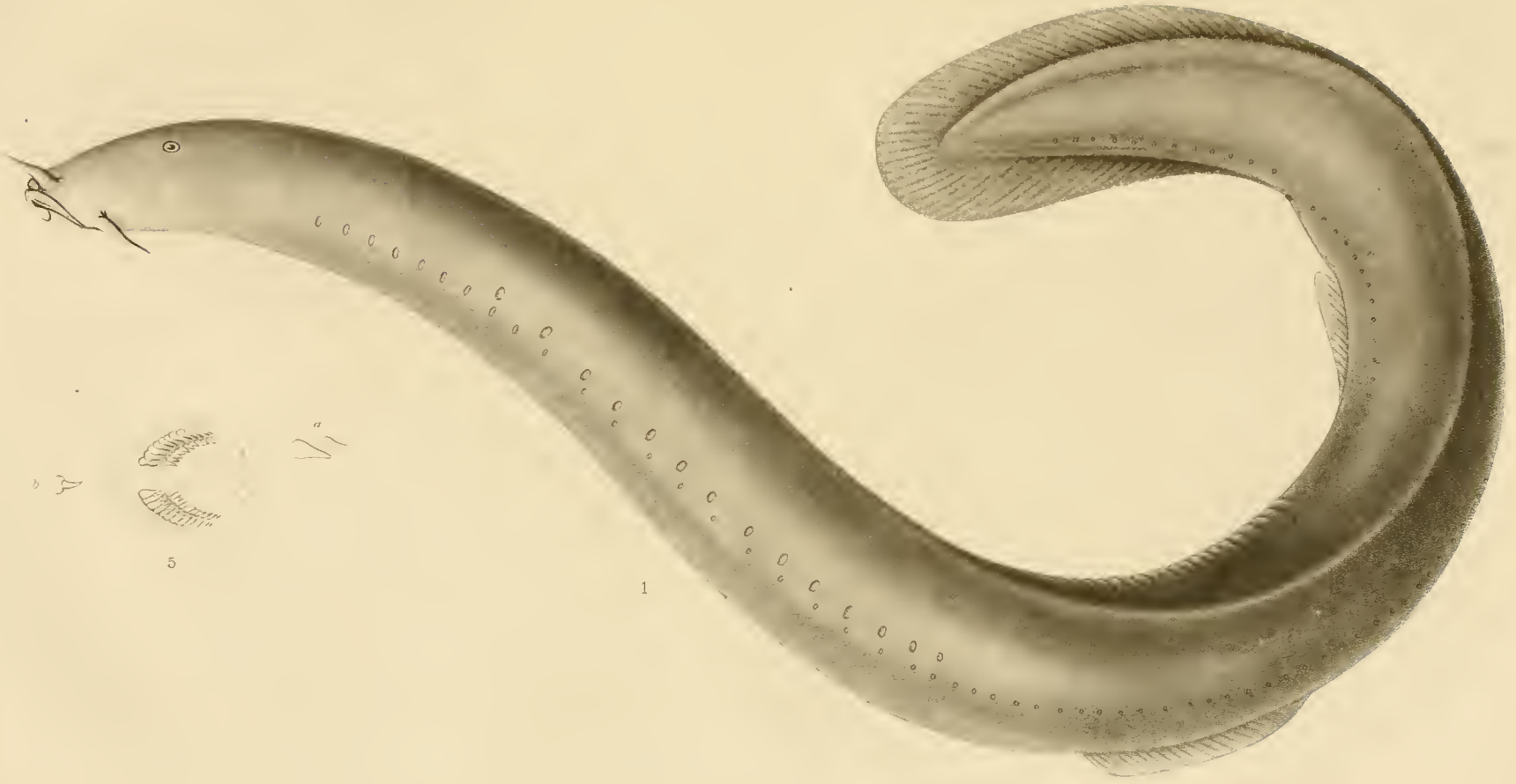


1

5

There is no dorsal fin. The caudal fin surrounds the extremity of the tail, extending a little farther forwards above than below, and tapering gradually towards, or else rising gradually from, the outlines of the caudal region. The anal fin is long, but very low. The vent is situated about six tenths of an inch from the posterior margin of the latter fin.

The precarious state of keeping the unique specimen which was obtained at Valparaiso, leaves us in doubt as to whether the bluish slate color of its epidermis was a true approximation towards its natural hue.

Plate XXXIII, fig. 1, represents *Bdellostoma polytrema*, size of life.

fig. 2, is an outline of the head, seen from above, exhibiting the cephalic distance between the eyes, the position and direction of three pairs of tentacles.

fig. 3, being a front view of the head, exhibits the nasal opening (*a*), and the same tentacles as in fig. 2.

fig. 4, which is the head, seen from below, shows the four pairs of tentacles, (*b*, *c*, *e*, *f*,) as well as the mouth (*d*), and nasal aperture (*a*).

fig. 5, is the tongue, with its double and arched series of conical teeth—*a* being two detached teeth, and *b* the palatine tooth.

DESCRIPTION OF CERTAIN CRUSTACEA, BROUGHT HOME BY THE U. S. N. ASTRONOMICAL EXPEDITION.

BY CHARLES GIRARD.

The Crustacea collected are but few, and of the Decapod division: some Brachyura, an Anomoura, and a Macroura, constitute the entire list.

The latter two, *Æglea* and *Rhynchocinetes*, constitute, each in itself, a natural group; both their structural peculiarities, and the deep interest which their history consequently involves, have suggested the following detailed descriptions of these two types.

DECAPODA ANOMOURA.

CENOBITIDÆ ÆGLEIDÆ.

Genus ÆGLEA, Leach.

Gen. char. Carapax depressed, longer than broad, anteriorly tapering, dilated upon the branchial region, diminishing in width posteriorly, and biarticulated. Frontal region armed with an acute rostrum. External antennæ about the length of the carapax. External maxillaries pediform. Posterior segment of the thorax movable. Legs of moderate size. Abdominal region shorter than the thoracic; broad, reflexed inferiorly and anteriorly, composed of six or seven segments, five of them bearing oviferic legs.

Syn. *Æglea*, Leach. Dict. Sc. Nat. XVIII, 1850, 29.

Obs. At the time this genus was instituted, there was but one species known, *A. lævis*, an inhabitant of the coast of Chile. Recent investigations have brought to light a second, from the same litoral, and to-day we add a third to the list, inhabiting the fresh waters of the mountainous regions of the Chilean republic, not knowing, however, whether it is altogether peculiar to that geographic range.

A great deal remains to be done in order to ascertain whether these species are really distinct from one another. In the want of authentic specimens of both *A. lævis* and *A. denticulata*, I was not prepared to remove all the doubts I had entertained in regard to their zoölogical similarities and dissemblances. With upwards of twenty-five specimens, including both sexes, of *A. intermedia*, before me, I have been compelled to avail myself, for their determination, of the writings of my predecessors in the field; and this has been done with the most earnest desire to arrive at the truth on this subject. I candidly confess that had I had but one specimen and but one sex, I would have hesitated describing it as a new species. But since my materials were ample, and the specific characters hence drawn were found not to vary throughout the whole range of the specimens examined, I felt much less justified in calling them either *A. lævis* or *A. denticulata*, than ascribing to them a new name.

The description given below, it may be trusted, will enable my followers in the field, with the assistance of similar materials from the coast of Chile, to determine the true zoölogical

relations which may exist between the marine and fresh water representatives of this interesting genus.

To facilitate their researches, I subjoin the references I have gathered touching the history of the two species described by different authors.

ÆGLEA LÆVIS, Leach.

Syn. *Galathea lævis*, Latr. Encycl. Méth. Crust. Pl. cccviii, fig. 2.
Ægleа lævis, Leach, Dict. Sc. Nat. XVIII, 1820, 49.
Desm. Consid. Gén. Crust. 1825, 186, Pl. xxxiii, fig. 2.
Latr. in *Cuv.* Règn. Anim. IV, (2d edit.) 1829, 84.
Griff. *Cuv.* Anim. Kingd. XIII, 1833, 184, Pl. vii, fig. 2.
Miln. Edw. Hist. Nat. Cr. II, 1837, 258; Atlas du Règn. Anim. de Cuvier, Pl. xlvii, fig. 3.
Edw. et Luc. in *D'Orb.* Voy. Amér. Mérid. VI, I. Crust. 1843, 34.
Nic. in *Gay*, Hist. de Chile, Zool. III, 1849, 199.
Dana, U. S. Expl. Exped. Crust. XIII, I, 1852, 476, Pl. xxx, fig. 6.

ÆGLEA DENTICULATA, Nic.

Syn. *Ægleа denticulata*, Nic. in *Gay*, Hist. de Chile, Zool. III, 1849, 200, Lam. ii, fig 1.

ÆGLEA INTERMEDIA, Girard.

Spec. char. Carapax finely punctate; rostrum moderate, acute, depressed (incurved) upon its middle, with its point slightly turned upwards. Edges of carapax subdenticulated; denticulations more conspicuous on the stomacal region than on the branchial region. Anterior legs larger in the male than in the female; in both sexes the arm has a prismatic shape, and is denticulated upon its upper and its lower and inner edges; the external lower edge being nearly smooth. Carpus provided with two rows of subconical tubercles (teeth) upon its upper and inner portion. Hand exhibiting internally a flattened processus, often denticulated. Inner edge of claws tuberculous or subtuberculous. Abdominal segments divided into three lobes, by an undulating line forming a subaneate triangle upon each segment.

Desc. The body is very much depressed, longer than broad; anteriorly about half the width of the posterior margin. The depth upon the middle region is about equal to the width of the anterior region immediately behind the orbits. The margin of the carapax is sharp and slightly indentated; the outline is slightly incurvated upon the suture which separates the thoracic from the cephalic region. The latter, convex upon its middle, is terminated anteriorly by a subtriangular, acerated, and carinated *rostrum*, slightly raised upwards upon its tip. On each side of the rostrum a semi-elliptical notch, at the external angle of which a small spine exists, constitutes the orbit. The suture, between the cephalic and thoracic regions, is very convex posteriorly upon the middle region, then slightly concave laterally and anteriorly, then again oblique towards the edge of the carapax.

The *thoracic region* is divided by two longitudinally shallow and smooth furrows into three regions—a medial or cardial, and two lateral or branchial regions. Again, it divides transversally into three regions also—an anterior, a medial, and a posterior; the last embracing a very narrow space upon the posterior extremity of the carapax, and extending but very slightly upon the branchial regions. The central portion of the cardial region is slightly convex, and limited by a sinuating depression or groove. The last segment of the thoracic region is move-

able, very small, posteriorly rounded and convex, laterally acute, giving points of attachment to two inferior, transverse, and very slender pieces, situated close to the posterior margin of the sternal shield, to which system the anterior piece undoubtedly belongs. The fifth pair of legs is likewise articulated upon that segment. Upon the extremity of the posterior transverse piece just alluded to, is articulated a rudimentary caudal appendage, or so called oviferic leg.

The *sternal shield* is subtriangular; its summit, which is directed forwards, being truncated. It is composed of four transverse pieces, soldered together, and corresponding to the anterior four pairs of legs. It is a little longer than the cardial region above.

The *eyes*, semiglobular in shape, are inserted upon a very short peduncle immediately beneath the base of the rostrum, and directed forwards.

The *inner antennæ* have a peduncle composed of three articles. The basal is globular, inserted immediately beneath the peduncle of the eye. The second article is the longest, very slender, subcompressed, slightly curved, implanted upon the inner edge of the first or basal, and provided upon its inner margin with a row of setæ. The third article is shaped like the second, more slender, and one third shorter: the antenna proper is about the length of the second article of the peduncle, compressed, tapering, consisting of eleven narrow articles, the inferior edge being provided with a double series of very short setæ. A filiform, eight-jointed appendage, may be observed inserted at the upper and anterior margin of the third article of the peduncle, and shorter than the anterior proper.

The *external antennæ*, inserted upon the same transverse line as the inner, are slender, elongated, cylindrical, and tapering to a point, composed of narrow and somewhat irregular articles, upon a length of nearly one inch and a quarter. Their peduncle, about a quarter of an inch long, is composed of four articles, two of which might almost be considered as forming but an irregular odd basal, at the upper and anterior margin of which a rudimentary processus may be observed. The two remaining articles are subcylindrical: the fourth is the longest.

The *inferior labia*, or else anterior abdominal segment, on the sides of which the external jaw-legs articulate, is very small and bidentate.

The *external jaw-legs* are pediform, provided internally with setæ, and composed of six articles besides the basal. Upon this, and exteriorly, is inserted the *palpa*, the first article of which is exceedingly small; the second slender, subcompressed, and elongated; the third, small and cylindrical, is followed by a lanceolated, thin blade surrounded with setæ. When stretched out, the tip of the palpa extends to the base of the terminal article of the jaw-leg properly so called. The first article of the jaw-leg proper is the smallest of the six composing it; the second and third, subprismatic in shape, are the largest; the fourth, fifth, and sixth, are subdepressed, the latter conical, and the three together equal in length to the second and third combined.

The *second pair of jaw-legs* consists of the same number of parts as the first or external pair, viz: of a palpa and a mandible; both being composed of the same number of articles; its differences consisting in a smaller and more slender form, and in the palpa being more elongated than the mandible, with its first article almost as long as the second. Setæ occupy the same edges and surfaces.

The *first mandible*, or *third pair of jaws*, is composed of a triple foliaceous cochloid piece, subcrenated upon its margin, each expansion being provided upon its base with a rudimentary palpa, and the external having in addition an elongated membranous expansion which extends towards the gills.

Finally, the *second* or *inner mandible* (*fourth pair of jaws*) is an elongated and rigid piece, composed of three articles intimately soldered together: the third article being the most developed of the three, and terminated by a subcircular and interiorly concave head, giving to the whole the form of a small dipper, at the upper and anterior part of which a small rudimentary palpa may be seen, inclined inwardly.

The *anterior* or *upper labia* is small and tuberculiform, situated in a concavity of the episteoma concealed by a slight ridge.

The anterior—pincers or claws-bearing—pair of legs is the stoutest and longest of the ambulatory appendages. The second, third, and fourth pairs are flattened; the second a little longer than the third, and the third a little longer than the fourth. The fifth pair is very exiguous, folded inwardly, and not used at all as an ambulatory organ.

The first (basal) article in the anterior four pairs of legs is similar in shape and structure in all; preserving, however, their due proportions.

In the first pair of legs the second article is subprismatic, short and stout, larger than the first article, angular anteriorly and inwardly, provided with a few rudimentary spines along its inner edge. The third article (arm) is prismatic, tapering, posteriorly provided with a row of small spines upon its edges, and subtubercular upon its anterior margin. The fourth article (carpus) is short, subtriangular and stout, provided upon its inner edge with a double series of tubercular spines. The fifth article (hand) is subelliptically rounded exteriorly, flattened inwardly, and provided upon its inner margin with a flattened processus, subcrenated upon its edge. The inferior claw, slightly curved inwardly, is concave upon its middle, and margined with a series of transversally elongated and depressed tubercles disposed upon a double row towards its base. The upper claw is elongated, subcylindrical, tapering, curved downwards, thus forming an arch above the inferior one; being similarly provided upon its margin with a series of flattened, transversally-elongated tubercles, largest posteriorly.

The second, third, and fourth pairs of legs are composed of six articles, including the basal, already alluded to. The second article is the second also in size; then the fourth (carpal), which is slightly bent downwards; then the fifth; the third is the longest of all; the sixth (tarsal), about equal to the fifth in length, is very slender, cylindrical, tapering, and terminated by a minute spine.

The fifth and exiguous pair of legs, inserted, as stated above, upon the post-thoracic and moveable segment, is composed first of a very small subglobose article, followed by four others more elongated and slender, subequal, slightly diminishing in length from the base towards the tip, which consists in a rudimentary claw concealed under a tuft of setæ and moveable upon the fifth article.

The caudal region is shorter than the carapax; bent upon its middle, and brought forward beneath in close contact with the inferior surface of the body, the extreme margins of the caudal paddle covering the posterior half of the sternal shield. It is composed of five segments, divided into three lobes by a lateral undulating groove. The posterior four segments are angular, and acute externally, while the anterior one is rounded; all being margined with a series of setæ. Inwardly and laterally they are provided in the female with rudimentary three-jointed, egg-bearing legs. A subpentagonal thin piece, as sixth segment, terminates that region, having on either side caudal paddles composed of a basal subtriangular piece inserted partly upon the fifth segment, and directed forwards; whilst on the latter are inserted, towards its external extremity, two subelliptical plates, margined with setæ as well as the central piece, and directed backwards and inwards.

The main surface is minutely punctured; the second, third, and fourth pairs of legs are provided with short and scattered setæ, more thickly set, and more developed upon the tarsal article.

The body and tail are bluish yellow above, yellowish beneath. The legs are reddish and bluish, and the antennæ reddish.

Specimens were collected in the upper affluents of the Rio de Maypu, 2,000 feet above the level of the sea, near Santiago.

DECAPODA MACROURA.

PALÆMONIDÆ ALPHEINÆ.

Genus RHYNCHOCINETES, Edw.

Gen. char. Body moderately compressed; carapax exhibiting a spinous processus towards the middle of the region of the stomach. Fronto-interocular margin provided with three spines; two more spines may be observed laterally upon the same anterior margin. Rostrum very large, sword-shaped (ensiform) attached to the front by a gynglymic articulation in a vertical plane, allowing a free motion downwards between the antennæ, and upwards to a vertical position of its axis. Its length equals, or exceeds a little, that of the carapax. It is toothed, or else denticulated upon its edges. Eyes conspicuous, and, when brought forward, find a resting place in an excavation of the peduncle of the superior antennæ, the basal article of which is large, and armed exteriorly with a spiniform blade. The terminal threads of these appendages are two in number, and constructed as in *Hippolytus*. External jaw-legs pediform and elongated; their terminal article is slender, cylindrical, and spiny upon its apex. A rudimentary palpiform appendage may be seen exteriorly at the base of each leg. Tarsus of second pair of legs not multiarticulated. First pair of legs larger than the others, and stretching beyond the peduncle of external antennæ; pincers short and spoon-shaped; finger moveable and toothed. Second pair of legs very slender, terminated by a small chela, and shorter than the third; the tarsus of the latter and the following pairs being short and toothed as in *Hippolytus*. Abdomen not different from the latter-mentioned genus. Several pairs of small spines upon the median blade between the caudal paddles. Gills, nine on either side of the thorax, disposed upon a double row.

Syn. *Rhynchochinetes*, Edw. Ann. Sc. Nat. Deux Sér. Zool. VII, 1837, 165.—Hist. Nat. Crust. II, 1837, 383.
Edw. et Luc. in *D'Orb.* Voy. Amér. Mérid. VI, I, Crust. 1843, 35.
Nic. in *Gay*, Hist. de Chile, Zool. III, 1849, 215.

Obs. There is one point in the history of this genus which cannot be looked upon with indifference by naturalists—the fact that the only species on record, when first described, was given for fatherland the Indian ocean. Specimens thus labelled had been deposited in the museum of the Garden of Plants in Paris, and these became the originals from which Milne Edwards's first description was drawn. As such it was produced in the *Histoire naturelle des Crustacés*.

Subsequently, Alcide d'Orbigny brought to the same establishment specimens collected at Valparaiso, which, on being submitted to Milne Edwards, were pronounced identical with those previously described, and Valparaiso given as locality for the species, without any further remark upon the subject. Nicolet, in Claude Gay's *Historia de Chile*, follows Milne Edwards's determination; adding, however, that the sole species hitherto known of this genus was indigenous both to the Indian ocean and to Chile. Dana, in his *Report on the Crustacea of the United States Exploring Expedition*, adopts the views of his predecessors in regard to the identity of the species, ascribing to it, in his tables of geographic distribution, a still wider range, since it is stated to occur in the northern zone of the western coast of the Pacific ocean.

The question now occurs as to whether the specimens labelled "Indian ocean," in the Paris Museum, do really belong to that district, or else got a wrong label; no mention being made by any one as to the channel through which they have been obtained. The figure published

at the time in the *Annales des Sciences naturelles* is a female, answering altogether to the specific features in the specimens of the same sex now before us.

There can be also no doubt as to the specific identity of both d'Orbigny's and Gay's figures, the originals of which were procured at Valparaiso. They both represent the female.

Specimens of both sexes were brought home by Lieutenant Gilliss. In the female the external maxillipes are equal in length to the distance between the apex of the rostrum and the articulation of the caudal region upon the thorax. The first pair of legs extends to nearly the serrated portion of the rostrum; the apex of their chela, therefore, does not reach as far as the extremity of the latter organ. The tip of the second pair of legs is even with that of the first pair, though inserted behind it. The third pair of legs is the longest, projecting beyond the second and first pairs, and extending to nearly the apex of the rostrum. The tip of the fourth pair is nearly even with the second and the first. Finally, the extremity of the fifth pair reaches the base of the last article of the third pair; its tip, therefore, remaining behind that of all the others. The rostrum is equal in length to the middle line of the cephalo-thoracic region. Now there can be no doubt as to the identity of these specimens with those figured by d'Orbigny and Gay.

In the male the external maxillipes are nearly as long as the absolute length of the animal, since they equal the distance between the apex of the rostrum and the middle of the length of the caudal paddles. The first pair of legs is stouter, the hand more elongated, and extending beyond the apex of the rostrum for the whole length of the finger. The second pair is very slender, hardly reaching with its extremity the middle of the hand, and not quite as far as the denticulated portion of the upper edge of the rostrum. The third pair extends to the base of the moveable finger or upper portion of the big claw, and consequently a little beyond the apex of the rostrum. The tip of the fourth pair is nearly even with, mayhap slightly longer than the second. Finally, the fifth pair slightly projects beyond the base of the last article of the third pair. The rostrum is somewhat longer than the middle line of the cephalo-thoracic region. The antennæ are longer than in the preceding instance. In every other particular both sets of specimens appear to agree perfectly. Those from which our description is drawn belong to the latter group.

RHYNCHOCINETES TYPUS, Edw.

Spec. char. Dull greenish, variegated with yellowish red. Locomotory appendages and jaws transversally barred or annulated with pinkish. Patches of the latter hue are also observed upon the convexity of the caudal region.

Syn. *Rhynchocinetes typus*, Edw. Ann. Sc. Nat. 2de Série VII, Zool. 1837, 165, Pl. iv, C.—Hist. Nat. Crust. II, 1837, 383.

Edw. et Lucas, in *D'Orb.* Voy. Amér. Mérid. VI, 1; Crust. 1843, 36, Pl. xvii, fig. 1.

Nic. in *Gay*, Hist. de Chile, Zool. III, 1849, 216; Crust. Lam. 1, fig. 7.

Rhynchocinetes typicus, Dana, U. S. Expl. Exped. Crust. XIII, I, 1852, 568, Pl. xxxvi, fig. 7.

Descr. The following description is based upon the male: The entire length, from the tip of the rostrum to the extremity of the caudal paddles, is four inches and a quarter; the rostrum measures one inch and an eighth; the middle line of the cephalothorax one inch and a sixteenth.

The cephalothoracic region is rounded above, compressed, deeper than broad, smooth, with the exception of the anterior extremity, which is provided with eight acerated points; two of which being situated upon the middle line, and one immediately above the base of the rostrum:

the other is behind it, at a distance of about an eighth of an inch. One pair of spines may be seen—one on each side of the postrostral—immediately above the orbit. Another pair occupies the externo-inferior angle of the orbit. Finally, a third and very small pair may be observed at the inferior and anterior angle of the carapax.

There are nine gills on each side, disposed in a double series, in the following manner: The external series, composed of five of these appendages, are much the smallest; the anterior one rests upon the base of the external jaw-leg; the four remaining ones are situated immediately above the insertion of the anterior four pairs of ambulatory legs. The gills of the inner series, four in number, are disposed obliquely opposite the insertion of the ambulatory legs; they increase gradually in size from forwards backwards.

The *jaw-leg* (external or sixth pair of mandibles) is three inches and a quarter long, stretching beyond the apex of the rostrum for about the half of their length, and composed of five articles. The basal is a circular ring, bearing a very small palpiform appendage, placed transversally, and directed backwards. The second article is subtriangular, very small, developed only upon the outer or inferior aspect of that organ, and upon its inner edge is a slender, palpiform, subarticulated appendage, nearly two thirds the length of the third article, tapering, flattened, and provided upon its inferior edge with a series of closely-set hairs or setæ. The third article itself is three quarters of an inch long, anteriorly subcylindrical, posteriorly concave immediately beneath the mandibles, for whose benefit this concavity exists; its antero-superior edge is provided with two small spines. The fourth article is small, about a quarter of an inch long, subcylindrical, and spineless. The fifth article measures two inches and three sixteenths; it is slender, cylindrical, and tapering towards its extremity, which is provided with five or six minute spines.

The *mandibles of the fifth pair* (proceeding from the innermost or first) are composed of five articles, the fifth and largest of which is flattened and bent downwards upon the fourth, which is the smallest. Exteriorly to the first or basal article arises a processus, bearing a membranous palpa and a subcircular flap, above which, and from the external edge of the second article, may be seen, stretching forwards, a palpiform appendage about half an inch long, and exhibiting distinct traces of transverse articulations, most numerous towards its extremity. The third article is of moderate development.

The *fourth pair of mandibles* consist of but one article each, thin, foliaceous, subtriangular, cochloid, provided upon the posterior portion of its base with a double, subelliptical, membranous expansion, and directed forwards; a crustaceous expansion, terminating in two small, filiform pseudopalpæ, one larger than the other.

The *third mandible* is composed of a few very thin, foliaceous, and rounded pieces, broadest towards the mouth, and provided upon their external margins with a crustaceous expansion, directed forwards, besides a tapering and hairy one extending backwards across the gills.

The *second mandible* consists of three small plates, two inferior, subcrustaceous, and flexible, whilst the third is rigid, cochloid, and provided upon its margin with a double and close series of very small, conical, and slender black spines. At the base and upper portion of this pair of mandibles may be observed a rudimentary palpa.

The *first or innermost mandible* consists of one piece only, subcylindrical upon its base, terminating anteriorly in processi, the inner of which is stout and blunt upon its apex, whilst the other is cochloid, and margined with a series of small, conical, black spines.

The *upper labia* is short and stoutish, flattened and rounded upon its margin.

The *external antennæ* are more than five inches in total length. The first article is short and stout; provided upon its anterior margin with a small spine, and upon its inner edge is inserted an elongated, sword-shaped, subtriangular appendage, anteriorly tapering to a point, and apparently composed of two elongated pieces soldered together, judging of this by the presence of a groove upon its external or upper surface. It is provided upon its inferior and crenated edge with a series of closely-set hairs or bristles. Beneath, and towards the inferior surface of the

first article, arise the antennæ proper: three articles (second, third, and fourth of the series) follow one another within a distance of about half an inch, the first two being small and irregular, the next is subtriangular or rather compressed; to the latter is appended the remaining portion of these organs, composed of narrow and circular articles, increasing in length up to the middle of their extent, hence diminishing again gradually towards their filiform apex.

The *superior antennæ*, two inches and three quarters in total length, are composed of a basal, rather large and subtriangular piece, anteriorly tapering into several points, followed by two small articles, upon the latter of which, the smallest of the series, are inserted: first, a filiform, transversally and minutely articulated antenna; and, second, a flattened, much shorter antenna (about half an inch long), provided inferiorly or interiorly with a series of closely-set hairs or setæ.

The eyes, inserted upon a short peduncle immediately above the superior antennæ, are large and conspicuous, and when inflexed they are lodged in a concavity of the basal article or segment of the organs just alluded to.

The *rostrum*, one inch and an eighth in total length, is very much compressed, and thin, tapering off towards its extremity, which is slightly curved downwards, and provided upon said curvature with ten acerated spines, directed forwards, the anterior one being the largest, and constituting the very extremity of that piece. Two more spines, similarly directed forwards, exist upon the upper margin, one near the base, the other a quarter of an inch anteriorly. The inferior edge is provided upon its whole extent with eighteen spines, similar to the anterior upper ones, but much larger and broader posteriorly. On the posterior edge of each of the latter spines exists a series of minute and closely-set hairs.

The anterior—pincers-bearing leg—is the stoutest and longest of the five pairs; the second pair is the most slender and the shortest; the third, fourth, and fifth pairs are equal as far as stoutness is concerned, but the third pair is a little longer than the fourth, and the fourth a little longer than the fifth pair, which is somewhat longer than the second.

The first (basal) and second articles in the five pairs of legs are similar and proportional in their development; the first is an annular ring, bearing a rudimentary palpiform appendage, similar to that observed upon the basal article of the jaw-leg; the second is subtriangular and acute exteriorly.

In the first pair of legs the third article is a little larger and more acute exteriorly than the second. The fourth article is long, compressed towards its base, and subcylindrical anteriorly, where it is provided with a small spine. The fifth article is short, subprismatic, bearing a large spine upon its anterior margin, and several small ones beneath and exteriorly. The sixth, which forms the claw, is the stoutest and longest, bearing upon its extremity three small, black spines; the upper piece of the claw is slightly arched, bearing upon its convexity a well-developed tuft of hairs; its anterior extremity is provided with a series of about a dozen small, black spines, largest near the apex.

In the second pair of legs the third article is nearly as long as the fourth, and similar to the latter in shape, in a reverse position. The fifth article is the longest, and subcylindrical. The sixth article, which bears a small claw, is likewise subcylindrical, or slightly compressed and elongated. The moveable upper piece is provided anteriorly with four small, black spines, whilst there are but two below.

In the third, fourth, and fifth pairs of legs the third article is a little larger than the second, and also more acute. The fourth article, the longest of all, is compressed, and provided along its external edge with three or four small spines. The fifth article, one-third shorter than the sixth, is likewise compressed, and provided externally with a few minute spines. The sixth is slender, a little shorter than the fourth, provided with exceedingly minute spines beneath, and terminated by a subconical and slightly-curved spine, moveable upon the latter, representing a seventh article.

The caudal region, composed of six segments, is rather stout, compressed, higher than broad

upon the extend of the first segment, the third being considerably developed upon its upper region, which is prominently convex. The remaining portion of the tail is very much reduced, tapering posteriorly, bent downwards and forwards under the body. The lateral and free expansions of the anterior three caudal segments are rounded off; that of the second segment is the largest, subcircular in shape, external, and covering partly the expansions of the first and the third segments. In the fourth and fifth segments that expansion is subtriangular, posteriorly acute. The sixth ring has no such lamellar expansions, but is provided upon its posterior and inferior angle with a slight ridge, at the inner margin of which a row of setæ is observed similar to that which exists upon the external margin of the lamellæ of the other segments. The central caudal appendage, subconical in shape, elongated and tapering, is convex above, concave beneath, and terminated by three pairs of spines; a very minute external pair, and two median, the upper one very slender, and two thirds the length of the lower pair, which is the most conspicuous. Along the upper and convex surface there are three pairs of rather short, stoutish, though small spines. On each side of this central appendage, and inserted in a concavity of the lateral and posterior edge of the sixth segment, with one spiny processus above and below, is another appendage composed of a short basal piece, upon which are inserted two moveable very thin lanceolated lamellæ, provided upon their edges with well developed setæ disposed upon one close series. The inner lamella is made of a solitary piece; the external one is composed of two pieces, the undulated and transversal articulation of which may be seen across the posterior third of said lamella, exteriorly marked by two small spines belonging to the largest piece.

The *caudal* or *oviferic legs*, five in number (one pair for each anterior five caudal segments), are of moderate development, the second and third pair being the largest. The posterior four pairs are similarly constructed. They consist of a flattened article, terminated by two narrow, elongated, thin blades, margined with setæ. The anterior pair is distinguished from the others in the structure of the terminal pieces, the inner of which is short and rather broad, and deprived of setæ upon its edge, whilst the outer one is similar to those of the other legs, being, however, considerably smaller.

The surface of the carapax is almost entirely smooth; a minute, prickly granulation becomes visible under a magnifying glass and to the touch also. This granulation is more apparent upon the locomotory and other appendages than elsewhere. The upper margin of the large claw is provided with an elongated tuft of setæ extending from the anterior portion of the hand (so called) along the convexity of the finger to near its apex. An elongated cushion of short setæ may also be observed along the convexity of the finger to near its apex. An elongated cushion of short setæ may also be observed along the inner surface of the third, fourth, and the base of the fifth article of the jaw-legs. Scattered bristles or setæ exist along the inner surface of most of the articles constituting the legs, and principally upon the mandibles.

The ground-color is yellowish; the sides of the cephalothorax and tail are variegated with irregularly meandric, fuliginous red maculæ. The appendages are annulated with purplish red. The third caudal ring is purplish upon its convexity, exhibiting two parallel light vittæ along the upper surface of the anterior three rings, uniting at an acute angle upon the posterior portion of the third ring. The caudal legs are spotted with fuliginous red.

The specimens were caught in Caldera bay.

LIST OF SHELLS BROUGHT HOME BY THE U. S. N. ASTRONOMICAL EXPEDITION.

BY AUG. A. GOULD.

Chiton aculeatus. Lin. Coquimbo.
" spirriferus. Frembly.
" magnificus. Desh.
" olivaceus. Fremb.
" peruvianus. Lamk.
" granasus. Fremb.
" cumingii. Sowerb.
Oliva Peruviana. Lamk. Coquimbo.
" " *var. Senegalensis.*
Turbo niger. Gray.
Trochus ater. Lesson.
" araucanus. D'Orb.
Murex crassilabrum.
" horridus. Sowerb.
" boivinii. Kien.
Fissurella latimarginata. Sowerb.
Calyptræa pileus.
" peruviana.
Littorina peruviana. Gray.
" araucana. D'Orb.
Bulimus erythrostoma. Sowerb.
Acmœa viridula.
" *var.* achates.
" scutum. D'Orb. and Eschh.
" scurra. Less.
Triton scaber. King.
" rudis. Sowerb.
Nassa rubricata. Gould.
Meradesma donacia. Lamk.
Cytherea pannosa? D'Orb. Two or three shells are confounded under this name.
Mytilus. *Undetermined.*
Planorbis. *Undetermined.*
Dombeya (chilina) fluctuosa.
Cardium unedo.
" fragum.
Conus ebumeus.
Ricimula horrida.
" albilabris.
Monoceros crassilabrum. Lamk.
Oliva gultata.
" jaspidea.
" elegans.
" flammulata?
Strombus gibberulus.
Cerithium lineatum.
Cyprea moneta.
" annulus.
" cicercula.
" ebumea.
" fimeriata.
Venus pannosa. Sowerb.
Terebra cinerea.
" striata.
Nerita albicilla.
" le grillouana.
Neritina canales. Sowerb.
Siphonaria lessoni. Blainv.
Natica uber.
Melampus. *Undetermined.*

APPENDIX G.

BOTANY.

LIST OF THE DRIED PLANTS BROUGHT FROM CHILE BY THE U. S. N. ASTRONOMICAL EXPEDITION.

BY ASA GRAY.

LIST OF LIVING PLANTS AND SEEDS.

BY WM. D. BRACKENRIDGE.

LIST OF DRIED PLANTS BROUGHT HOME BY THE U. S. N. ASTRONOMICAL EXPEDITION.

BY ASA GRAY.

FROM CHILE.

Silene gallica. Linn. Introduced from Europe.		
Medicago maculata. Willd. do. - - -	Vulg.	Hualputa.
Asteriscum chilense. Cham. and Schlecht. - -		Muchu and Anisillo.
Scyphanthus elegans. Don (Grammatocarpus volubilis, Presl.)		Mongita.
Buddleia globosa. Lamk. - - - - - - -		Pañil.
Lippia canescens. Kunth.		
Ambrina ambrosioides. Spach. - - - - -		Paico.
Tupa salicifolia. Don. DC.		
" polyphylla. Don. var. latifolia.		
Prosopis siliquastrum. DC.? - - - - -		Algarrobo.
Loranthus tetrandrus. R. and P. - - - -		Quintral.
Geranium rotundifolium. L. - - - - -		Corre-corre.
Cestrum parqui. L'Hér. - - - - - -		Parqui.
Leonotis leonurus. R. and Pav. Introduced.		
Mentha piperita. Linn. do. - - -		Yerba buena.
Cichorium intybus. Linn. do. - - -		Achicoria.
Fumaria agraria. Lag. do. - - -		Fumaria.
Cuscuta chilensis. Choi. - - - - - -		Cabello de Anjel.
Trevoa trinervia. Hook. - - - - - -		Trevu.
Eccremocarpus scaber. R. and Pav.		
Centranthus ruber. DC.		
Agati grandiflora. Dew.		
Cassia tomentosa. Lam.		
Hoffmanseggia falcaria. R. and Pav. - - -		Porrotillos.
Medicago sativa. L. Introduced. - - - -		Alfalfa.
Genista cumingii. Hook. and Arn.		
Lathyrus sessilifolius. Hook. and Arn.?		
Viviania rosea. Hook. - - - - - -		Oreganillo.
Anemone decapetala. Linn. - - - - -		Centello.
Schizopetalon walkeri. Hook.		
Malesherbia linearifolia. R. and P.?		
Epilobium denticulatum. R. and P.		
Loasa floribunda. H. and Arn.		
Loasa placei. Lindl.? - - - - - -		Ortiga macho.
Bowlesia multradiata. Colla.		
Sanicula macrorhiza. Colla.		

Stellaria cuspidata. Willd.		
Matthidla incana. R. and Br. - - - -	Vulg.	Aleli.
Oxalis geminata. Hook. and Arn. - - -		Ojos de agua.
" arenaria. Bertero.?		
Godetia cavanillesii. Spach.		
" tenuifolia. Spach.		
Cruckshanksia hymenodon. Hook. and Arn.		
Schizanthus pinnatus. Ruiz. and Pav. - - -		Pajarito.
" hookeri. Gillies in Bot. (Benth. in DC.)		
Calceolaria polifolia. Hook.		
" nudicaulis. Benth.		
" paralia. Cav.		
" indeterminable. Two species.		
Alonsoa incisæfolia. R. and P. - - - -		Flor del Soldado.
Mimulus luteus. (Var. guttatus.)		
" parviflorus. Lindl.		
Gilia laciniata. R. and P.		
Galium eriocarpum. Bartl.		
" relbun. Endl.? - - - - -		Relbun.
Teucrium bicolor. Smith.		
Sphacele subhastata. Benth.		
Gardoquia gilliesii. Graham. - - - -		Oreganillo.
Eritrichium fulvum. DC.		
" fulvum.?		
Heliotropium floridum. Hook and Arn.		
Phacelia circinata. Jacq.		
Convolvulus dissectus. Cav. - - - - -		Correjuela.
Hagenekia oblonga. R. and Pav. - - - -		Guayo Colorado, Huayu ó Bollen.
Fabiana imbricata. R. and Pav. - - - -		Pichi.
Verbena erinoïdes. Hook. and Arn. - - -		Yerba del incordio and Sandia la-
" ribifolia. Walp.		huen.
Nicotiana angustifolia. R. and Pav. - - -		Tobaco cimaron.
Scytalanthus acutus. Walp. (Neriandra. DC.) -		Cuernecilla.
Witheringia tomatillo. Gay. Solanum Dunal. -		Tomatilla.
" crispa. Gay.? Solanum Dunal. -		Natri é Yerba del Chevalongo.
Eucelia oblongifolia. DC. - - - - -		Coronilla de Fraile.
Bahia ambrosioïdes. Lag. - - - - -		Manzanilla cimarona.
Centauria melitensis. L. Introduced. - - -		Zizaña.
Galinsoga parviflora. Cavan. - - - -		Paico. Jullo, &c.
Bidens chilensis. DC.		
Centaurea chilensis. H. and Arn. - - -		Escabiosa, Yerba del Mincro.
Senecio serenensis. Remy. in Gay. (Doubtless some older species also.)		
Eupatorium salvia. Colla. - - - - -		Salvia Macho.
" glechonophyllum. Less. - - -		Barba del Viejo.
Baccharis pinilloriana, Remy. (or B. pingræa.)		
" concava. DC. - - - - -		Gaultro, Guanchu.
" pingræa. Less. Remy. Mas.		
Tylloma glabratum. DC.		
Chœtanthera multicaulis. DC.		

LEUCERIA HIERACIOÏDES. Cess.
" ACANTHOÏDES. Don.
CHABRÆA ROSEA. DC.
MOSCHARIA PINNATIFIDA. R. and Pav.
ATRIPLEX PERUVIANA. Moq. in DC.
STILLINGIA LIGUSTRINA.?
ARISTOLOCHIA CHILENSIS. Bridges.? - - - - VULG. Oreja de Zorra, &c.
MUHLENBECKIA INJUCUNDA. (Polygonum injucundum, Bot. Reg.) - - - Quilo, in Coquimbo, Mollaca.
DIOSCOREA OBLURIFOLIA. Hook. and Arn.?
CHLORÆA MULTIFLORA. Lindl.
SISYRINCHIUM ANDICOLUM. H. and Arn.; and two or three other species.
AMARYLLIS CHILENSIS. Spreng. - - - - - Añeñuca.
MARICA STRIATA. Bot. Mag.?
PASITHEA CÆRULEA. Don.? - - - - - Pajarito.
TRICHOPETALUM STELLATUM. Lindl.
LEUCOCORYNE ALLIACEA. Lindl. - - - - - Gnillis.
ORNITHOGALUM GRAMINEUM. Bot. Mag.? - - - Flor de la cuenta.
AVENA FATUA. Linn.

FROM THE ANDES AND BUENOS AYRES.

PORTULACA HIRSUTISSIMA. Camb.
COLOGANIA HILEROPHYLLA. Gillies.
ACÆNA MACROSTEMON. Hook. f.?
BERBERIS EMPETRIFOLIA. Lam.
PHACA ELATA. H. and Arn.
LARREA DIVARICATA. Cav.? - - - - - Jarrilla.
HIBISCUS BIFURCATUS. Cav.?
CLEOME HEPTAPHYLLA. Linn.?
CERCOSTYLOS BRASILIENSIS. Less.

LIST OF LIVING PLANTS AND SEEDS SENT FROM CHILE TO THE GOVERNMENT GREEN HOUSE.

BY WM. D. BRACKENRIDGE.

Acacia cavenia. Benth. - - - - - -	Vulg. Espino.
Acacia lophantha.	
Allium roseum. Linn. - - - - - -	Lagrima de la Virgen.
Alstrœmeria–? Linn. - - - - - -	Peregrina.
Amarola glandulosa.	
Amaryllis belladona. - - - - - -	Azucena.
Anemone hepaticœfolia. Hook. - - - -	Flor de la Estrella.
Anona cherimolia. Mill. - - - - - -	Cherimoya.
Apuritia vulgaris. - - - - - - -	Tuna.
Araucaria imbricata. Pav. in Mem. Acad. Madrid. -	Piñon.
Aristotelia maqui. L'Her. - - - - -	Maqui.
Boldoa fragrans. Pav. (syst. fl. per. 260.) - -	Boldo.
Bromelia sphacelata. Ruiz and Pavon. - - -	Chupon.
Calandrinia longiscapa and discolor. Schrad. - -	Renilla.
" grandiflora. Lind.	
Calceolaria integrifolia. Linn.	
Calceolaria. Lin. - - - - - - -	Arguenita.
Cassia frondosa. Ait.	
Cereus quisco. - - - - - - - - -	Quisco.
Cestrum parqui. L'Herit. - - - - - -	Parqui.
Chlorea speciosa. Pœpp. - - - - - -	Azucena del campo.
Convolvulus. Dub. in DC. - - - - -	Correjuela.
Cucurbita maxima. Duch. - - - - - -	Zapallo.
Datura arborea. Lin. (Ruiz and Pav.) - - -	Floripondio.
Dolichos ruber. - - - - - - - -	Enredadera.
Dubana dependens. DC. - - - - - -	Huingan.
Erodium cicutarium. Leman: in DC. - - -	Alfilerillo.
Fragaria chilensis. Ehrh. - - - - -	Frutilla.
Fragaria vesca. Linn. - - - - - -	Fresa.
Fumaria media. Lois. - - - - - -	Fumaria.
Guevina avellana. Mol. - - - - - -	Avellano.
Gunnera chilensis. Lam. - - - - - -	Panque.
Habranthus. Herbert. - - - - - -	Amancay.
" chilensis. Herb. - - - - -	Añeñuca.
Jubœa spectabilis. H. B. and Kunth. - - -	Lilla and Cancan.
Lapageria rosea. Ruiz and Pav. - - - -	Copigue.
Laurus peumo. - - - - - - - - -	Peumo.
Leucocoryne odorata. Lindl.	
" alliacea. Lindl. - - - - -	Guillis.

Litrea venenosa. Miers. - - - - - - Vulg.	Litre.
Lorantius tetrandrus. Ruiz and Pav. - - -	Quintral.
Lucuma odorata. Dehumb. - - - - -	Lucuma.
" valparadisea. Mol. - - - - -	Lucumilla.
Lupinus microcarpus. Linn. - - - - -	Alberjilla.
Maytenus chilensis. DC. - - - - - -	Mayten.
Medicago sativa. Linn. - - - - - -	Alfalfa.
Myrtus coquimbensis. - - - - - -	Arrayan.
Œnothera berteriana. Spach. - - - - -	Don Diego de la noche.
Ornithogalum gramineum. - - - - -	Flor de la cuenta.
Oxalis lobata. Sims. - - - - - -	Flor de la Perdiz.
Parkinsonia aculeata. Linn.	
Poinciana. Tourn.	
" gilliesii. Hook. - - - - -	Barbon.
Phaseolus caracalla. Linn. - - - - -	Caracol.
Physalis pubescens. Linn. - - - - -	Capuli.
Puya coarctata. Ruiz and Pav. - - - -	Chañar.
Quillaja saponaria. Molina. - - - - -	Quillay.
Retanilla ephedra. (Colletia ephedra, Vent. Choix, t. 16.) - - - -	Frutilla del campo.
Salpiglossis sinuata. Ruiz and Pav. - - - -	Panza de Burro.
Scilla chloroleuca. Kunth. - - - - -	Cebolleta.
Tricuspidaria dependens. Ruiz and Pavon. - -	Patagua.
Triticum vulgare. Vill. - - - - - -	Trigo.
Tropœolum majus. Linn. - - - - - -	Capuchina, and
" tricolorum. Sweet. - - - - -	Pajarito.

Most of these have been propagated; and there are more than 200 plants of the Araucaria imbricata, large numbers of the Jubæa spectabilis, sixty to eighty bulbs apparently belonging to the families of Amaryllideæ, Asphodeleæ, and Hemerocallideæ, besides many singular Tilleaceous bulbs from the desert of Atacama.

APPENDIX H.

PALEONTOLOGY.

DESCRIPTION OF A PORTION OF THE LOWER JAW AND A TOOTH OF THE MASTODON ANDIUM; ALSO, OF A TOOTH AND FRAGMENT OF THE FEMUR OF A MASTODON FROM CHILE.

BY JEFFRIES WYMAN.

SOME REMARKS ON THE ORGANIC REMAINS FROM CHILE, WITH DESCRIPTIONS OF THE SPECIES.

BY T. A. CONRAD.

Dougal Sc.

O.J.Wallis.

MASTODON ANDIUM, Cuvier. ½ Natl Size.

FOSSIL MAMMALS.

BY JEFFRIES WYMAN, M. D.

Description of a portion of the lower jaw of MASTODON ANDIUM *of Cuvier, also of a tooth and fragment of the femur of a Mastodon, brought from Chile by Lieut.* J. M. GILLISS, U. S. N.

From the various recorded discoveries of the remains of Mastodons in South America, it appears that they once had a geographical range over nearly the whole of that continent, since they were found by Humboldt as far north as Santa Fé de Bogota, especially at the *Camp des Géans*, where they were collected in great numbers; and have also been discovered as far south as Buenos Ayres, on the Atlantic, by Admiral Dupotet, at Concepcion de Chile* on the Pacific, and at various intermediate points in Peru, Chile, La Plata, Brazil, and Columbia, by Dombey,† Gay,‡ Alcide d'Orbigny, Darwin,‖ and others. Thus their remains extend from 5° north to about 37° south, and on both sides of the great chain of the cordilleras, from ocean to ocean. What is still more remarkable, the bones of Mastodons have been discovered at unusually great elevations, according to d'Orbigny, even up to the borders of perpetual snow.§ One of the molars, described by Cuvier, was obtained by Humboldt on the volcano of Ibambura, at an elevation of seven thousand and two hundred feet above the level of the sea.

The specimens submitted to me for examination by Lieut. Gilliss, and which are here described, were exhumed in an attempt to drain the lake of Tagua-Tagua, in the province of Colchagua, about one hundred and five miles south of Santiago, about sixty from the Pacific, and at an elevation of about fourteen hundred feet above the level of the sea. The lake, in latitude 34° 18′ south, lies in a basin at the foot of the central range of the cordilleras, and is completely closed in except at its outlet, which is through a narrow channel towards the southeast and through a narrow gorge to the west, which last, however, was above the level of the lake. In this gorge a drain was cut, and, as the waters flowed off, was gradually extended into the lake until it reached nearly two hundred yards from the margin, where, at a depth of twenty feet below the bed, the bones of a large animal were discovered, and eight or ten yards from these some others. They attracted but little attention at the time, and, in consequence, many of them were either destroyed or dispersed. The larger portion of those now known to exist are in the museum at Santiago. Those here described were presented to Lieut. Gilliss by Mr. Richard Price, an English gentleman, long resident in Chile. They consist of a broken lower jaw, a molar tooth, and the fragment of a thigh-bone.

PLATE XII, Figs. 1 and 2.

I. *Fragment of a lower jaw.*—This comprises the horizontal portion of the right side, extending from the symphysis, which is entire, to the base of the coronoid process, which is broken off, the fractured surface sloping obliquely backwards to the commencement of the "angle;" this

* Cuvier states that Humboldt gave him a tooth which he had brought from Concepcion de Chile. (Oss. Foss, 4me edition, T. II, p. 370.) Lieut. Gilliss has called my attention to the fact, that Humboldt did not personally visit that locality. A probable explanation of the statement is, perhaps, to be found in the circumstance that the tooth may have been presented to Humboldt by some one who brought it from Concepcion de Chile; and still more probably, as Lieut. Gilliss suggests, it may have been obtained from a town of the same name near the equator, which Humboldt actually did visit.

† Cuvier, Oss. Foss., Tome III.

‡ Gay, Hist. Nat. de Chile.

‖ Geological Observations in South America, by Charles Darwin, F. R. S. &c.; London, 1851, p. 103.

§ Darwin, Op. Cit., p. 105.

last, in so far as can be predicated from what remains, must have been very regularly rounded. The left branch is quite short, being broken just in front of the first molar tooth. The dimensions of the fragment are as follows:

	Inches.
Length of specimen	14.50
Length from symphysis to base of coronoid process	12.50
From symphysis to base of first molar	5.00
Space between right and left branches of jaw	2.75
Symphysis from before backwards	4.75
Length of alveolar portion	6.00
Width of gutter at extremity of symphysis	0.75
Transverse thickness of jaw at base of coronoid	4.75
Height of jaw in front of coronoid	4.25
Height of jaw in front of first molar	5.00
Transverse thickness of jaw at coronoid	4.75
Transverse thickness of jaw at base of first molar	2.50

The inner face of the jaw is nearly vertical, and is almost exactly parallel to the median line, except posteriorly, where it diverges from it and becomes convex. The lower edge of the jaw is horizontal, but the upper or alveolar portion ascends rapidly from behind forwards till it reaches the anterior extremity of the first molar, where it becomes continuous with a sharp ridge having a slightly serpentine outline, and converging as it descends forwards towards a similar one from the opposite side; and the two include between them a gutter or channel, which is met with under various modifications in both Mastodons and Elephants. This channel is continued, gradually diminishing, to the most prominent part of the chin, where it terminates in a rounded depression; but a small, narrow groove extends from this last about three inches along the under side of the symphysis. When seen in profile, the symphysis forms a slightly depressed beak, with a regularly rounded extremity. This part in other Mastodons is usually quite pointed, the symphysis having the appearance of having been obliquely truncated. The greater elevation of the front part of the alveolar portion is doubtless to be attributed to the worn condition of the tooth; the former being generally built up as the latter wears away, and thus keeping the grinding surface constantly on the same level. The canal for the mandibular branch of the fifth pair of nerves is about one half of an inch in diameter at its posterior portion, lies quite near to the inner face of the bone near its lower border, and running parallel to it till it reaches a point near the first molar, where it passes obliquely forwards to the outer surface, on which it opens by a single foramen just in front of the tooth, and midway between the upper and lower edge.

The teeth consist of two molars in place, and of a fragment of a third which is imperfectly developed, and the points of which had not yet risen above the edges of the alveoli.

The *anterior tooth*, (Pl. xii, Figs. 1 and 2, IV,) which, from the existence of an anterior and posterior supplementary ridge or talon, may be regarded as the fourth in the complete dental series, has the crown worn down quite near to the base of the ridges, traces of all of which—viz: the three principal and the two supplementary ones—still remain. The dimensions of this tooth are as follows:

	Inches.
Length	2.75
Breadth in front, at anterior ridge	1.50
Breadth posteriorly, at third ridge	1.75

The inner side of the crown is less worn than the outer, so that nearly all the traces of the transverse ridges have disappeared externally; but on the inner side they are represented in transverse sections, which have the characteristic trefoil-shaped appearance. At the bottom of the interval, between two adjoining ridges, are converging grooves of enamel which unite in a common channel.

The *second molar*, the fifth of the dental series, (Figs. 1 and 2, V,) is much larger than the preceding; has its three principal ridges arranged rather more obliquely to the axis of the tooth; has a small talon in front, and another much more largely developed behind. The dimensions are as follows:

	Inches.
Length	3.80
Breadth across first ridge at base	2.00
Breadth across third ridge at base	2.40
Height of ridges, about	1.00

The anterior talon, though below the level of the other ridges, is much worn; it occupies the outer half of the front of the tooth only, and its section gives the half of a trefoil, the folded side being directed backwards. The first ridge is a little worn, and, like the others, is deeply cleft in the centre, the two sides of the cleft being in close contact. The third ridge is fractured; the inner half being broken away, the cleft is exposed to the depth of three fourths of an inch. The external half of each of the three ridges is folded in such a manner as to form a salient projection or buttress on its anterior and posterior face, and each meets a corresponding projection from the ridge in front and behind. The foldings of the inner half of each ridge are not so well defined. The posterior talon is cleft in the middle, and each lateral half is composed of a large, stout tubercle slightly bifid at the apex. There is no basal ridge in this tooth; but there exists between the first and second and the second and third ridges a lobed projection on the inside, and on the outside, between the first and second ridges, a tubercle. A thin layer of cement exists in the interstices of the ridges at some points; and though generally detached or worn off from the summits, yet in one instance it was found as high as the apex.

The fragment of a *third molar*, the sixth of the dental series, (Figs. 1 and 2, VI,) is that of an immature one, still lodged in the socket, the points just reaching to the level of the edge of the alveolus. One ridge, with a small anterior talon, is preserved; also, the broken base of a portion of the second ridge. The anterior one is about one inch and three fourths high, is deeply cleft in the middle, and each half again partially subdivided so as to form two tubercles upon its summit: the external ones are the largest and highest; the internal tubercles are continuous posteriorly with a salient ridge, that of the outer half of the tooth being the largest. Behind the ridge just described, the tooth becomes suddenly broader, measuring three inches and an eighth in width, the enlargement being made mainly on the outer half. The fangs of the tooth had but just begun to be developed, the crown still consisting of a hollow shell; no cement was deposited as yet upon the enamel.

The great increase in size of this tooth anteriorly, when compared with that which precedes it, as well as its actual measurements, indicate that it is the sixth or ultimate member of the entire molar series. By a comparison of the series of lower molar teeth of *M. Humboldtii*, given by Falconer & Cautley, (Pl. 40, Figs. 10, 13, 14, and 15,) which comprises the whole series of molars, from the second to the sixth inclusive, it will be seen that while the anterior extremity of each successive tooth up to the fifth is but little broader than that which preceded it, the sixth becomes at once much broader and longer than its predecessor; its greatest breadth being in front, and gradually diminishing in size to the posterior extremity.*

*The following measurements, from Falconer & Cautley, (Pl. xl, Figs. 13, 14, and 15,) will serve to give the proportional sizes of a series of lower teeth, except only of the first:

Molar II. Fig. 13	$2\frac{3}{16}$ inches.
" III. Fig. 13	$3\frac{9}{16}$ "
" IV. Fig. 15	$4\frac{5}{16}$ "
" V. Fig. 15	$5\frac{11}{16}$ "
" VI. Fig. 14	$8\frac{1}{16}$ "

The fifth and sixth molars of the jaw from Chile, figured by Blainville, have the following proportions:

Molar V.	6 inches.
" VI.	9 "

GENERAL REMARKS.

In the fourth edition of the *Ossemens Fossiles*, Cuvier, in describing the *Mastodontes à dents étroites*, speaks of the similarity between the teeth brought from Peru by Dombey and Humboldt, also between those brought by the latter from the Camp des Géans, near Santa Fé de Bogota, and the *Mastodon angustidens* of Europe. He even goes further, and asserts the specific identity between one of the teeth brought from Peru, and another brought from Simmore, in Europe;* and consequently regards *M. angustidens* as a South American as well as a European species. He also established, or rather suggested, two additional species peculiar to South America, which he denominated *M. Andium* and *M. Humboldtii*, which are more especially distinguished by their difference in size.†

De Blainville, always an antagonist to the opinions of Cuvier, after reviewing the whole subject in all its details, expresses the conviction that but one species exists in South America—viz: *M. Humboldtii*—in which are included the *M. Andium* and *M. Humboldtii*, as well as the remains described by Cuvier as identical with *M. angustidens* of Europe;‡ and Dr. Falconer§ appears to adopt the views of De Blainville, but they have been strenuously opposed by Laurillard, the friend and coadjutor of Cuvier.

De Blainville was undoubtedly correct in differing with Cuvier as to the identity of *M. angustidens* with any South American species. Cuvier's opinion is not only opposed by anatomical facts, but by what appears to be the rule with regard to the geographical distribution of animals, and which in his time was but imperfectly understood. From what is now known in relation to the geographical range of species, we should not expect any Mammal, and the least of all a gigantic Pachyderm, to be an inhabitant of two continents so widely separated as Europe, or even Asia and South America, at the same time no members of the same species being found in North America, which intervenes.

As regards the existence of the two species—M. Andium and M. Humboldtii—while De Blainville has taken a position so decidedly in opposition to that of Cuvier, and has been followed, as it appears, by Dr. Falconer, they both seem to have overlooked some of the facts in the case which tend to show the existence of two species at least. Among the different figures of molars illustrating the dental series of South American Mastodons, Cuvier‖ gives one of a sixth or ultimate molar, De Blainville¶ four, and Falconer** four; making in all nine different specimens of ultimate or sixth molars. The size of each of these is readily determined, as they are all drawn to a scale indicated on the plates. The following table will give the full dimensions of the different ultimate molars figured by the authors mentioned above, and will show their relative proportions:

		Inches.
I—1.	Cuvier, Pl. xxviii, Fig. 4, (Dombey's specimen)	6
2.	De Blainville, Pl. xii, (from Peru, much worn)	$6\frac{6}{8}$
3.	De Blainville, Pl. xii	6
4.	Falconer, Pl. xl, Figs. 12 and 12^a	$6\frac{9}{16}$
5.	Falconer, Pl. xl, Fig. 10	6

* "Malgré l'éloignement des lieux, il m'est donc impossible de ne pas reconnoitre ces deux dents comme de la même espece."—Cuvier, Oss. Foss., 4me edit., T. II, p. 338.

† Op. Cit., p. 368.

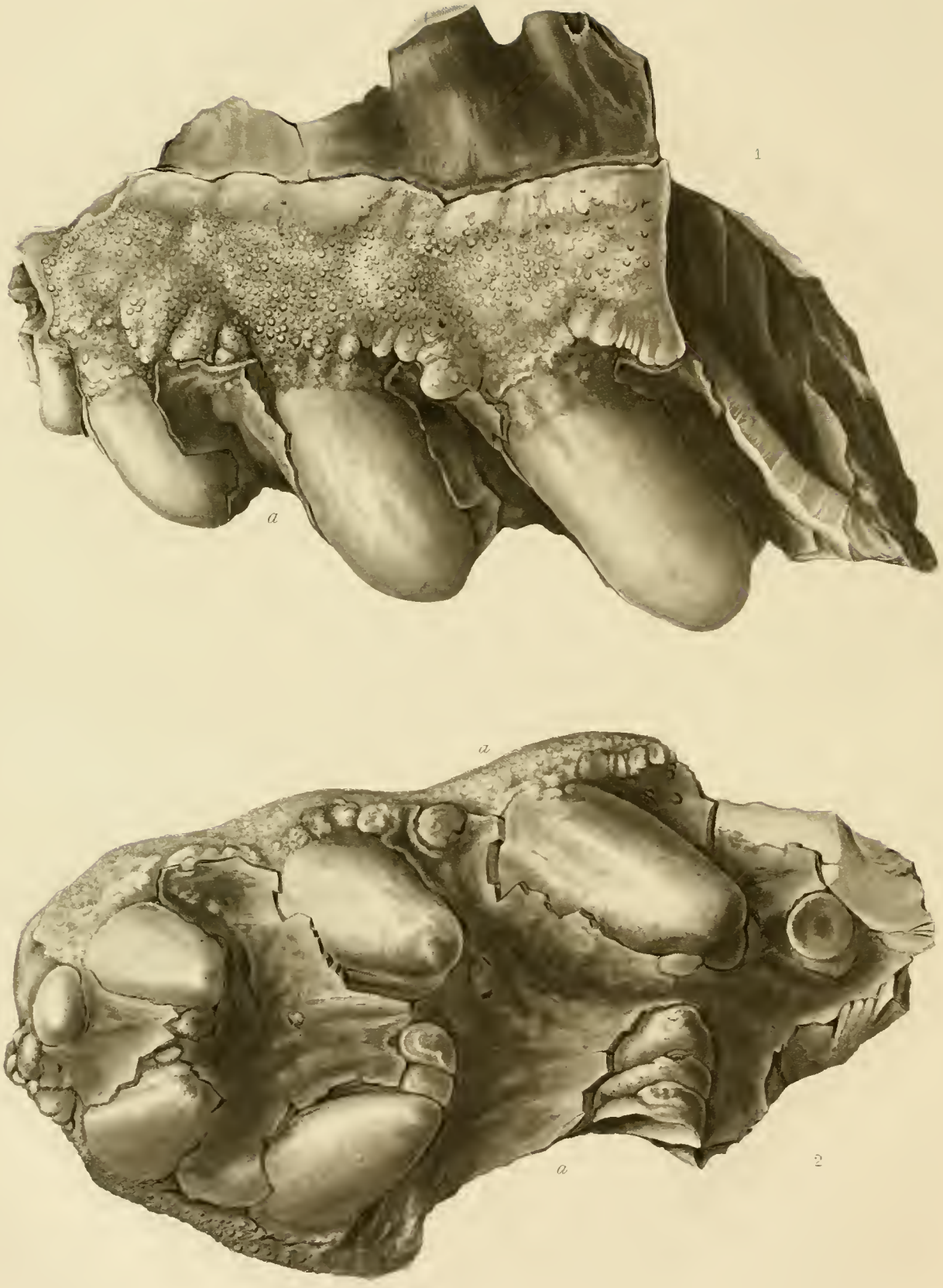
‡ De B., in the same chapter in which he discusses the identity of species, refers the celebrated remains once described as those of Teutobocchus to *M. Humboldtii*.—Osteographie, G. Elephas, p. 286.

§ "The South American teeth which he (Cuvier) distributed among three nominal species—viz: M. Andium, M. angustidens, and M. Humboldtii—appear to be all referable to a single form, the M. Andium (Humboldtii?) of De Blainville."—*Fauna Antiqua Sivalensis*, by Hugh Falconer, F. R. S., &c., and Proby Cautley, F. G. S., &c: London, 1846; Part I. p. 19.

‖ Oss. Foss., Tome II, p. 339, and figured in Pl. xxviii, Fig. 4.

¶ Osteographie, Genus Elephas, Pl. xii.

** Fauna Antiqua, Plates xxxv, xl, and xliv.



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MASTODON ANDIUM Cuvier. Natl Size

		Inches.
II—6.	De Blainville, Pl. xii, Buenos Ayres - - - - -	9
7.	De Blainville, Pl. xii, Chile - - - - - - -	9
8.	Falconer, Pl. xxxv, Figs. 3 and 3ª, (lower jaw) - - -	9
9.	Falconer, Pl. xl, Fig. 14 - - - - - - -	$8\frac{1}{16}$

From the above measurements it will be seen that these nine molars may be arranged in two distinct groups: those in one measuring between six and seven inches in length, and those in the other between eight and nine. The ninth specimen is nearly an inch shorter than the other specimens of the same group, which may be attributed to the circumstance of its belonging to the upper, while the others belong to the lower jaw.

Not only does there exist this difference in the dimensions of the teeth, but there is good evidence for the belief that a corresponding one exists in those of the lower jaw. Of these, De Blainville gives the dimensions of three fragments, Cuvier of one fragment, and Falconer of an entire mandible; to these should be added the fragment described in this notice, the dimensions of all of which are, respectively, recorded in the following table, an allowance having been made for the last portions.

		Inches.
1.	Falconer, Pl. xxxv, Figs. 3 and 3ª; entire - - - -	30
2.	De Blainville, Chile; broken off at angle, length more - -	30
3.	De Blainville; broken at symphysis and angle, about - -	20
4.	Cuvier, Pl. xxviii, Fig. 4; broken at angle, about - - -	20
5.	Specimen from Tagua-Tagua, about - - - - -	20

The estimated length of the broken specimens is based upon the proportions of the entire mandible figured and described by Falconer, as above. The broken mandibles are all fractured just behind the first molar, which corresponds very nearly with the base of the coronoid process. The length of the jaw behind the base of the coronoid is a little more than one third of the whole length. Although the above estimates have not the accuracy that is desirable, yet they clearly indicate the existence of jaws which acquire quite different dimensions, viz: of thirty inches and of about twenty inches. The ultimate molars contained in those of thirty inches in length were nine inches, while in those of twenty they were six inches in length; not only do the shorter ones contain ultimate molars, but in one instance the tooth is ground quite to its base, so that only traces of the transverse ridges remain.

From the facts which have just been mentioned, we have strong evidence, in confirmation of the opinion of Cuvier, that there exists a large as well as a small species of Mastodon in South America. The lower jaw from Tagua-Tagua corresponds with those of the smaller dimensions, and which Cuvier recognised as affording the basis for a distinct species. If the existence of the second species—viz: *M. Andium*—be not admitted, the only alternative which remains is to suppose that an ultimate molar may range in its length, in different individuals, from six to nine inches, and the lower jaw from twenty to thirty inches. The existence of two species—viz: *M. Andium* and *M. Humboldtii*—distinguished, as Cuvier stated, by difference in size, seems by far the more probable view.

PLATE XIII, Figs. 1 and 2.

II. *Sixth molar of Mastodon Humboldtii.*—The single broken tooth which was sent in company with the lower jaw presents some peculiarities of structure which render it desirable that it should be described separately. It is an upper molar, of which the anterior portion is broken off; but a slight abrasion of some of the anterior points which remain shows that it had come into use. Its greatest breadth is in front, and becomes, as is usual in ultimate molars, gradually more narrow posteriorly. Its length is six inches, and its breadth three and a half; it has four ridges remaining, and a conical nipple which forms the posterior talon. If it had five ridges, which is the case generally in ultimate molars, its entire length must

have been between nine and ten inches. All the ridges were covered with a layer of cement, (Figs. 1 and 2, *a a*,) but in many places it had become accidentally detached. Near the base of the tooth it had the thickness of one fourth of an inch. The enamel which invests the base of the crown is tuberculated throughout; and between the bases of the transverse ridges are to be seen at the outer border longitudinal ones, the upper edges of which are more or less multifid. Each transverse ridge is composed of two very unequal portions separated by a deep cleft: one portion consisting of a very large conical tubercle, with a smaller one attached to, and as it were impressed into, the side towards the axis of the tooth; the other portion is composed of three tubercles of more nearly equal size, of which the outer one is the longest, all closely packed together; the cleft between these two portions, as seen on the broken anterior end, is one inch and a quarter in depth. A large tubercle is found in the middle of the space between the anterior and second ridges; also two smaller ones between the second and third; in both cases connecting two adjoining ridges with each other.

The unequal division of the transverse ridges, and the strongly tuberculated enamel on the base of the crown, do not appear to be represented in any of the different figures of the teeth of Mastodons, except, perhaps, in one instance, the molars from the Camp de Géans, figured by Cuvier, where there is an indication of a longitudinal tuberculated ridge; but the other peculiarities indicated above are not apparent. Were it allowable to establish a species on the authority of a single tooth, it might be done in the present instance; but, before such a step is taken, other specimens should be examined, in order to ascertain how far these individual peculiarities are constant.

If it be referable to either of the species referred to above as coming from South America, it would be to the larger species, where the molars are from nine to ten or more inches in length, viz: *M. Humboldtii—M. Andium* being applied to designate the smaller species.

III. *Fragment of a femur.*—This is the lower portion of the thigh-bone of the right leg. It does not appear to be wholly mature, as the line of separation between the epiphysis and the shaft of the bone is still distinct, though the co-ossification of the two has taken place. The following measurements give the dimensions and proportions:

	Inches.
Breadth through tuberosities	8
Breadth across condyles	7
Breadth of inner condyle	$3\frac{4}{8}$
Breadth of outer condyle	$3\frac{2}{8}$
Length of inner condyle	5
Length of outer condyle	4
Breadth of groove for patella	$3\frac{7}{8}$
Length of groove for patella	$4\frac{2}{8}$
Breadth of interval between condyles	$0\frac{5}{8}$
Depth of interval between condyles	$1\frac{1}{8}$

The inner condyle is the longest and most prominent, but the difference in length is less than in *M. giganteus*. The interval between the condyles dilates anteriorly into a pyriform space, of about one inch in its transverse diameter, for the attachment of the crucial ligament. The whole fragment is nine inches in length; and on the fractured end, which is triangular with a flattened apex, it measures seven inches in its transverse and four in its anterior-posterior diameters.

Note.—Since the preceding descriptions were written, Lieut. Gilliss has forwarded to me another molar of a *Mastodon Andium*, more recently received by him from Prof. Domeyko, of Chile. It was taken from Lake Tagua-Tagua, and belongs to the same species as the lower jaw already noticed. Its dimensions are as follows:

	Inches.
Length of crown - - - - -	4
Breadth at anterior ridge - - -	$2\frac{4}{16}$
Breadth of posterior ridge - - -	$2\frac{11}{16}$
Length of roots - - - - -	4

The crown is surmounted by three ridges, and is terminated at either end by a rudimentary one. The three principal ones are much worn, and give the usual characteristic trefoil-shaped sections; the right and left halves of each ridge are separated by a deep cleft, and the portions of enamel on either side of this are very distinctly crenulated, but those of the outer half much the most so. The outer section is likewise larger than the inner. There is no basal ridge, nor is the side of the crown tuberculated; the enamel generally is quite smooth, but is somewhat channeled in the interspaces of the inner halves of the ridges; on the outer border a blunt tubercle is seen between the bases of the first and second and the second and third ridges. These last are slightly oblique, their direction being outwards and backwards. The two roots which support the crown are about four inches in length, one of them being situated beneath the first ridge and the other beneath the second and the third; this last, however, is partially subdivided by a deep groove. The great length of the roots corresponds with the attrition of the crown, the former increasing as the latter diminishes in the ordinary use of the teeth.

This tooth is of the right side, and corresponds with the one marked V (Pl. xii, Figs. 1, 2) in the lower jaw, from which its dimensions vary but slightly.

REMARKS ON THE FOSSIL SHELLS FROM CHILE, COLLECTED BY LIEUT. GILLISS, WITH DESCRIPTIONS OF THE SPECIES.

BY T. A. CONRAD.

The few secondary fossils collected in Chile, that I have been requested to determine, appear to be referable to the Oolitic, although d'Orbigny has referred two of them to the Cretaceous period—his *Turritella Andii* and *Pecten alatus*. Coquand and Bayle have, however, arranged them in a section of the Oolitic group, which they have termed "Etaaes du Lias superieur à la Grypheé arquée et de l'oolithe inferieure." They name *Terebratula tetrœdra* and *T. ornithocephala*, Sowerby, as South American species; but two shells collected by Lieutenant Gilliss, though closely related to the former two, appear to be distinct. The *Turritella Andii* of d'Orbigny is found in Europe, but its geological relations are uncertain. There remain, then, only two species of Ostrea, the forms of which genus are not so satisfactorily compared with European types as in many other genera, and it is with some doubt I refer them to exotic species. There is in the collection of the Academy of Natural Sciences a species of *Terebratula* resembling *T. meridionalis*, and very likely identical with that which I have described in this report. It is said to have been obtained in the Andes, at the elevation of perpetual snow. None of these species of South American shells have yet been found in any part of North America; and, as the continent has been so frequently crossed by exploring expeditions, it is not likely they occur.

TEREBRATULA.

PLATE XLI, Fig. 4.

1. T. SUBEXCAVATA. Ovate from base to apex, with three folds at base; sides rounded; umbo not very prominent; basal margin profoundly sinuous.

Locality. Cordillera de Doña Ana; 13,432 feet above the ocean.

Allied to *T. perovalis*, Sowerby, but a very distinct species. The mesial fold is short and deep, and the lateral ones less deeply impressed. The umbo is not large, as in the *meridionalis*.

PLATE XLII, Fig. 10.

2. T. MERIDIONALIS, Conrad. Ovate, both valves ventricose; umbo prominent; sides and base rounded.

Locality. Cordillera de Doña Ana.

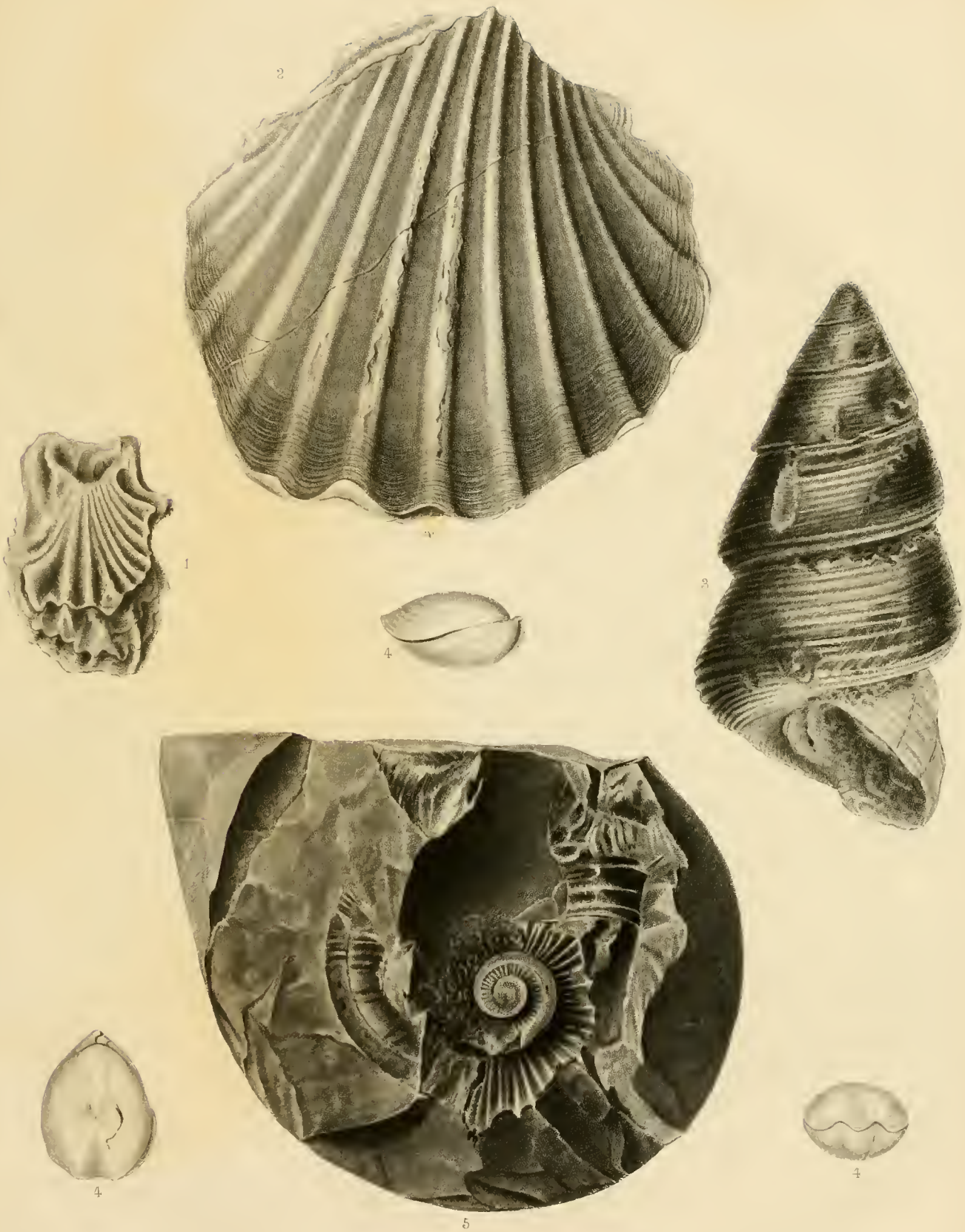
This species differs from *T. ovoides* of Sowerby, in being broader and more obtuse at base, &c.

PLATE XLII, Fig. 8.

3. T. SUBTETRÆDRA, Conrad. Suboval, with three prominent ribs on the mesial elevations, and five or six on the sides; ribs angular, acute.

Locality. Portezuelo de Manflas, 6,545 feet, and also on the Cordillera de Doña Ana, 13,432 feet, above the ocean.

Differs from *T. tetrœdra*, Sow., in its less ventricose form, and in having three instead of four or five plaits on the mesial elevation, &c.



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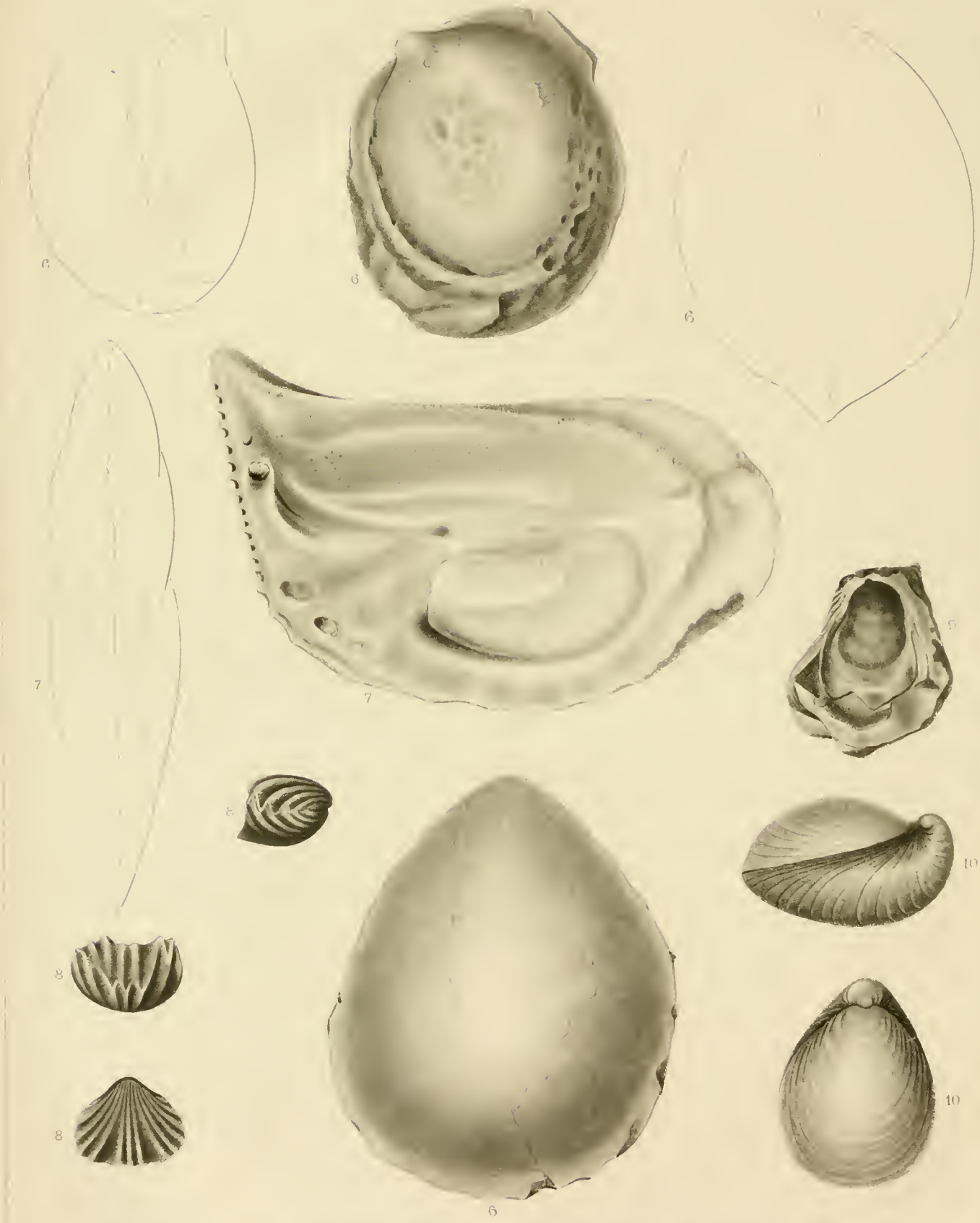
Dougal Sc.

Fig. 1. OSTREA GREGARIA, Sow Fig 2. PECTEN ALATUS, Buch. Fig. 3. LITHOTROCHUS ANDII, Conrad. Figs. 4. TEREBRATULA SUBEXCAVATA, Conrad. Fig. 5. AMMONITES.



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Figs. 6. Casts. Figs. 7. PERNA CHILIANA, Conrad. Figs. 8. TEREBRATULA SUBTETRAEDRA, Conrad. Fig. 9. OSTREA IRREGULARIS, Münst. Figs. 10. TEREBRATULA MERIDIONALIS, Conrad.

OSTREA, Linn.

Plate XLII, Fig. 9.

1. O. IRREGULARIS. Rhomboidal; lamelloso; striate concentrically; superior valve flat; inferior valve irregular, ventricose, sessile at the umbo or whole surface; sides ascending, subrugose.

Locality. Cordillera de Doña Ana.

O. irregularis, MUNSTER, GOLD. Petrif. vol. II, p. 20 to 79, Fig. 5.

Plate XLI, Fig. 1.

2. O. GREGARIA. Elliptical, encurved; inferior valve acutely carinated, affixed; superior valve plano-convex, folds simple, narrow, bifurcate.

Locality. Cordillera de Doña Ana, 13,432 feet above the ocean.

O. gregaria, SOW. GOLD. Petrif. vol. II, p. 7, Pl. cxxiv, Figs. 1, 2.

PECTEN?

Plate XLI, Fig. 2.

P. ALATUS. Inequilateral; anterior side of the larger valve considerably enlarged towards the base in form of a wing; ribs, fourteen, rounded below, flattened above; umbo very prominent; upper valve flat, a little excavated in the middle; ears small.

Locality. Cerro de Tres Cruces, in the province of Coquimbo, and 2,887 feet above the sea.

P. alatus, (Von Buch,) D'ORBIGNY, Petrif. rec. in Amer. par Humb. p. 3, Fig. 1—4.

This shell probably belongs to the genus *Neithea* of Drouet. D'Orbigny remarks that it forms entire mountains, and that Humboldt observed it in immense quantities at the height of 8,400 feet between Guambos and Montan, on the route from the river Amazon towards Lima.

LITHOTROCHUS, Conrad.

Plate XLI, Fig. 3.

Conical or trochiform; aperture contracted, subquadrate, entire; labrum not extending beyond the line of the body whorl above.

L. ANDII. Conical; whorls six (?); sides straight, oblique, carinated near the base, and angulated; whorls marked with conspicuous revolving lines; angle of the body whorl obtuse or rounded.

Localities. Coquimbo; San Felipe, Peru; near Hamburg.

Turritelli Andii, D'ORBIGNY, Voy. dans Amer. p. 104, Pl. vi, Fig. 11.
Pluerotomaria Humboldtii, DE BUCH. Petri. rec. en Amer. par Humb. Fig. 26.
Trochus Struvcanus, ZIM. DUNK. Palæont, p. 185, t. 26, Fig. 2.

This shell has been referred to two or three different genera, but it does not correspond in characters with any of them. I have no doubt of its being an extinct genus. Perhaps *Turritella Renauxiana*, d'Orbigny, a Cretaceous species, should be associated with it. Dunker's *Trochus Struvianus* was found among tertiary fossils, and he is in doubt whether it was out of place or not. It is most likely a stray Jurassic species; and, if so, is no doubt identical with the South American shell.

BELEMNITES.

B. CHILENSIS, Conrad. Subacicular; somewhat curved towards the apex, which is obtuse; sides flattened; groove profound, and terminating much below the apex.

Locality. Caldera.

Recent formation of Copiapó, Chile.

The collection of fossil shells obtained by Lieut. Gilliss consists of some of the common recent species of Chile, living as far south as Valparaiso. This recent formation, discovered upon the line of the Copiapó railroad, is an aggregation of fragmentary and water-worn shells, mixed with sea-sand and gravel in varying proportions, having evidently been a sea-beach during the existence of the present fauna, and now elevated from twenty-five to four hundred and twenty feet above the sea. Specimens of this rock are composed of fine fragments of shells, apparently cemented by carbonate of lime, and which consist chiefly of one species of bivalve, *Mulinia Byronensis*, a common recent species of Valparaiso. On the upper surface which marks the last deposition of shells previous to their elevation beyond the reach of the sea, many specimens of Mulinia are nearly entire, but always water-worn. On one specimen of this rock the most abundant shell is *Turritella cingulata*, also water-worn; and these two species chiefly compose this probably extensive rock formation. The other shells enumerated in the list appended are rare, and add little, therefore, to the bulk of the rock. It is evident, from these specimens, that the coast of northern Chile has been elevated more than four hundred feet, and to a distance of twenty-five miles from the Pacific, at a comparatively recent period. Indeed, these aggregations of shell fragments have a striking resemblance to those now forming on Anastatia island, on the Florida coast. Darwin, in describing the formations of Copiapó, does not allude to this rock, and therefore it has been probably exposed for the first time by excavations made for the Copiapó railroad. A large oyster-shell, found imbedded in a mixture of ferruginous quartzose sand and gravel, at an elevation of four hundred feet above the sea, is a species that I do not find described or referred to by authors, and it is probably tertiary fossil. It has a Balanus attached to it, very like one of the Miocene species.

Many of the specimens of concreted shells are no more altered in structure than those on the coast of Florida; but a specimen of this rock, from an elevation of four hundred feet, twenty-five miles from the coast, is of a sparry or crystalline structure, the fragments so small and water-worn that it is scarcely possible to ascertain with certainty the species of which it is composed, but is most probably made up of *Mulinia Byronensis*.

List of Shells in the recent formation of the Copiapó railroad.

UNIVALVES.

1. TURRITELLA CINGULATA, Sowerby.
2. CONCHOLEPAS PERUVIANA, Lam. One young specimen; elevation 138 feet.
3. FUSUS RECURVUS? Koch. One broken specimen.
4. TROCHUS MICROSTOMA, d'Orbigny. Rare; elevation 138 feet.
5. CREPIDULA DILATATA, Lam. Rare.
6. STREPHONA PERUVIANA, (*Oliva*, Lam.) Two specimens.
7. TROCHITA RADIANS, (*Calytræa*, Lam.) One specimen.

BIVALVES.

8. MULINIA BYRONENSIS, Gray.
9. TAPES LITHOIDA, (*Venus*, Jonas.) Elevation 138 feet; one valve.

10. MYTILUS OVALIS, Lam. One specimen.
11. PAPHIA DONACIA, Young. Rare.

No. 1. Darwin did not find this species among the recent upraised shells near Valparaiso. It is a common living species on that part of the coast of Chile, where it has been dredged up from a depth of ten to twenty fathoms. No. 2 is recent on the coast of Peru; No. 4, recent at Valparaiso; No. 5, ditto; No. 6, recent at Coquimbo and Copiapó; No. 7, living on the coasts of Chile and Peru; No. 8, living at Valparaiso; No. 9, living at Copiapó; No. 10, living on the coast of Peru. No. 11: Darwin says, that about Quintero there are immense accumulations of this species, packed in sandy earth. It lives north and south of Valparaiso, inhabiting sand-banks at the level of the lowest tides.

Tertiary Shells of Chile.

In the collection I find three shells which are probably extinct species, as they differ widely from any recent shells of the Pacific coast that we have in our collections or are described in scientific publications. They have no resemblance to Eocene species; but, from their correspondence with Miocene forms, I have scarcely a doubt that they will prove to be members of that formation. I have traced Miocene deposits from Columbia river, in Oregon, to San Diego, in California, by means of fossil shells collected by Townsend, Dana, Lieut. Blake, Dr. Heermann, and Dr. Leconte; and no doubt the same formation, or synchronous deposits, may yet be found at intervals from San Diego to Cape Horn, at greater or less distances from the coast, and sometimes, as in California, bordering the sea.

PERNA.

PLATE XLII, Fig. 7.

P. CHILENSIS, Conrad. Oblong-subquadrate; anterior hinge extremity somewhat rostrated; anterior margin rectilinear; hinge oblique, and furnished with about fifteen cardinal teeth; posterior margin and basal margin rounded; muscular impression oblong; subovate, very large.

Locality. Caldera, Chile.

This is a cast of a very large species, allied to *P. maxillata* of the Virginia Miocene, and measures ten inches from hinge to base. The muscular impression is remarkable for its size; measuring 4½ inches in length, and its greatest breadth three inches.

OSTREA, Linn.

O. COPIAPINA, Conrad. Upper valve obliquely oblong-oval, somewhat curved, ventricose, with very broad, not elevated, irregular radiating undulations; cartilage depression profoundly dilated; beak not prominent, submargins entire; muscular impression profoundly elongated, falcate; cavity capacious.

Locality. Line of Copiapó railroad.

This is a large species, measuring from beak to base seven inches; from anterior to posterior extremities, eight and a quarter inches. I have not seen the lower valve, but suppose it to be not very different from the opposite one. There are some large *Balani* attached to it, resembling a Miocene species of Virginia; but not being in good condition, it remains undetermined. These shells are imbedded in a brown quartzose sand, and were found at an elevation of four hundred feet above the sea.

Recent Species.

LAXICAVA.

L. CALDERENSIS, Conrad. Ovate-oblong; of a chalky whiteness; inequilateral; anterior and posterior margins acutely rounded; anterior side with broad, flattened, waved radiating ribs; posterior side with narrow, sub-acute, radiating, more prominent ribs; an oblique wide space on the disk without radii, or they are obsolete; surface with closely-arranged prominent wrinkled lines, larger posteriorly.

ADDENDUM.

METEORIC IRON OF ATACAMA.

BY DR. R. A. PHILIPPI.

[From the "Anales de la Universidad de Chile," for June, 1854.]

When hunting guanacos, some thirty or forty years ago, the meteoric iron of the Desert of Atacama was discovered by two Indians from the hamlet of Peine, situated some twenty-two leagues to the southeast of Atacama—José Maria Chaile and Matias Mariano Ramos—the latter now dead. Being white and soft when cut, they at first mistook it for silver, and Chaile extracted two masses from their places, each weighing five or six arrobas (of twenty-five pounds each), which were buried in the ground near the water-holes of Pajonal, though the spot of their concealment is no longer remembered. As soon as it was known that it was meteoric iron and not silver which they had found, many persons curious in such matters made expeditions in search of specimens, others asked like samples from residents of Atacama, who availed themselves of the inhabitants of Peine to obtain them, and I was told that even the blacksmiths of Atacama sought the iron for manufacturing purposes. The larger specimens were the first to be taken away; and now the iron is so nearly gone, that I am persuaded it will cost much time to any one who makes a journey in search of the few fragments of this mineral remaining.

This rare substance is found at one league in a southwest direction from the water-holes of Imilac—almost in the centre of the most arid and desolate part of the desert. Imilac is distant in a right line from the coast about thirty leagues, from Cobija forty leagues, and from Atacama thirty-five leagues. On the west, the nearest place where water can be had is at Aguas Blancas, some twenty-four leagues off; in the direction of Atacama, none exists nearer than Tilopaso, nineteen leagues distant; on the east it may be found at Pajonal, a journey of seven leagues, and at Punta Negra, twelve and a half leagues off, on the road towards Paposa. Imilac is a little hollow at an elevation of some 3,350 *varas*, or 8,620 French feet, above the level of the sea, with a small salt marsh near its centre, which produces a few gramineous plants, viz: a species of Festuca, the *Scirpus acicularis*, or a species very similar to it, a Ciperacea, and a Triglochin. Even these are so scarce that a dozen mules would find it impossible to satisfy their hunger. There is no other combustible than the dung of mules, and the plants eaten by the poor animals are charged with so much salt that this burns only after much difficulty, leaving a sort of black scoria instead of ashes. I found it impossible to boil water with it; and as observation of the temperature of ebullition was the only mode left to me by which to calculate the heights of these elevated places, after my aneroid no longer served and the mercurial barometer had become useless, the altitude assigned to Imilac can be considered only approximate.

One of the very discoverers of the iron, José Maria Chaile, served as my guide to the spot. In order to reach it, on leaving the water-holes of Imilac we turned to the southwest, entering a little valley with an eastern aperture, whose very gentle slopes are scarcely more than (30 or 40 varas) 110 to 120 feet high. After half an hour's travel, the first small specimen of iron was found, and ten minutes later we reached the principal place from whence it has been

obtained. At the bottom of the valley a hole eighteen to twenty feet deep has been excavated by Indians, who expected to encounter a vein of iron; and at several directions from this principal one, at distances of ten to twenty steps, there are other apertures and piles of rubbish two to three feet high, indicating, beyond doubt, the places from which the largest and heaviest pieces of this greatly-sought substance had been extracted. At Atacama I heard it said that there was still a large mass buried in the surface, and one Manuel Plaza told me, at Peine, that a very great specimen was rolled to the bottom of the valley; but I saw nothing of either. I remember reading, in a manual of mineralogy, that a stone weighing three hundred pounds had been obtained from here; but it must be a mistake, because masses of that weight cannot be carried by mules, and they afford the only mode of transport on the desert.

Arriving at the spot, we began the search for specimens. Nothing was found at the bottom of the valley or on the northern slope; but, in a search of more than an hour on the southern declivity, and at an elevation of seventeen to twenty-eight feet above the bottom of the valley, I found a very great number of small fragments, within a space from sixty to eighty steps long by twenty paces broad.

The surface has been formed from the decomposition of certain classes of porphyritic rocks, and is composed of a loose clayey earth mixed with an infinity of little stones, from the size of a walnut to that of an apple, and does not differ essentially from the greater portion of the desert. The porphyry may be termed granitic or sienitic, because, in a whitish, crystalline, felspathic component, of which the oxide of iron on the surface becomes reddish, we find disseminated grains of hyaline quartz, slightly inclined to gray, which are of the size of hempseed. Small black spots, more or less dendritic, appear to arise from manganese; but in some cases they are positively known to be amphibole, as in a specimen I have marked A. It is very rare to find, as in one marked B, any specimens containing small spots of white mica, which forms the transition to granite, and are more granular. Some of these stones have their surfaces covered with a black rust, which appears to be principally formed of the hydrated oxide of iron, as in the specimen marked C. The most remarkable thing is, that all of them have their angles very sharp, proving that they have not been rolled from afar, but were formed on the same spot by natural fracture of the rock.

The specimens I collected weigh three pounds, less three drachms, and number 673; so that the mean weight of each is twenty-three grains—the largest weighing two ounces, and the smallest one less than one grain. We may suppose that my companion, Don Guillermo Döll, obtained the same number, José Maria Chaile as many, and it is probable that one half remained unseen. Therefore the total number of pieces in that locality exceeded 3,000, without enumerating the many large stones carried away during the last thirty or forty years, and which there is no possible mode of estimating.

The smallest specimens have the forms of lamellæ. Among the larger of them there are many of arborescent lamellar forms, with intersecting lines as on paper that has been compressed in the hand and opened again. The surfaces of these are very black, and when collected some of them were iridescent. In their cavities transparent olivine is very distinctly seen, although it is full of crevices, and the hollows are somewhat regular as if the iron had introduced itself when in a state of fusion among already formed crystals of olivine. There are other pieces more compact. The olivine which we must suppose originally filled their cavities is generally very much decomposed and converted into a whitish-yellow, or a ruddy and earthy substance whose examination under a lens shows it to be composed of small vitreous or crystalline grains. It would be tedious to describe the varied and multitudinous forms of the Atacama iron; and the samples that I have the honor to present will save me the irksome task. I must mention, however, the largest specimen seen, and which is in the collection of our colleague Don Ignacio Domeyko. This mass weighs more than fifty pounds, and is of an irregular oblong form with somewhat smooth surfaces and sharp corners. Its smooth sides look as though they had been rubbed down, whilst its elongated extremities are rough and crooked, with indices of octahe-

ral crystallization. It has polar magnetism, the poles being near the two extremities of the mass, an interesting peculiarity which I do not remember as belonging to any other meteoric iron.

I may remark, further, that the diameter of the cavities filled with olivine is rarely so much as six lines, or less than two lines. One specimen appeared to be composed of two pieces which had fallen separately in a state of fusion, and on touching at a point they had become united. I also noticed specimens whose exteriors seemed to have been rubbed down as is observed on the outsides of numerous minerals taken from within the earth, and principally from metallic veins, a phenomenon only explicable on the supposition of a friction or sliding over one another during their motion. May we attribute the appearance which the surface of some of these meteoric masses have, to a like origin ?

It is clearly shown, in what has been said, that only a meteoric origin can be supposed for the iron of Atacama: it must have fallen from the atmosphere as did that of Aram and Braunan. The fragments are so delicate, so crisped, and have extremities so fine and sharp, that any hypothesis that they were transferred from another locality on the globe is inadmissible; we must admit that they were found on the spot precisely as we see them. Now, they lie upon the surface; they have the same chemical and physical characteristics as other meteoric iron: how, then, could we think them to have had other origin ?

I think we may conjecture, with a reasonable probability, the direction from which came the meteor furnishing these iron fragments. Remembering that the first samples are found ten minutes before reaching their principal locality and in a N. N. E. direction, and that almost all the specimens yet found lie on the slope facing to the north, none on that falling southward, we must almost necessarily believe that the great mass came from the N. N. E., lost some particles on its path, and burst in the place already described, scattering the small pieces as sparks on the slope, whilst the larger fragments either fell or rolled to the bottom of the valley.

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ADDENDUM.

An account of the locality where the meteoric iron is found in Atacama, translated from a memoir by Dr. Philippi to the University of Chile, and published in the "Anales de la Universidad, 1854," 287–289.

CORRIGENDA.

Page	8,	line	19,	for	las Puquios,	read	los Puquios.
"	19,	"	17,	"	Rosaria,	"	Rosario.
"	30,	"	41,	"	San Sosé,	"	San José.
"	61,	"	11,	"	San Nicholás,	"	San Nicolás.
"	73,	"	20,	"	$V=K^1\left(\frac{T^2}{T_1{}^2-T^2}\right)$	"	$K=K^1\left(\frac{T^2}{T_1{}^2-T^2}\right)$
"	160,	"	16,	"	Guanaco,	"	Guanaca.
"	160,	"	22,	"	bolos,	"	bolas.
"	170,	next	bottom,		quanaco,	"	guanaco.
"	171,	"	8,	"	hileusis,	"	chileusis.
"	175,	"	9,	"	Elanus lucurus,	"	Elanus leucurus.
"	175,	"	10,	"	Milvus lucurus,	"	Milvus leucurus.
"	175,	"	37,	"	Sess.,	"	Less.
"	181,	"	34,	"	cacruleocephala,	"	cœrulocephala.
"	182,	"	29,	"	Dict. PXXII,	"	Dict. XXXII.
"	186,	"	9,	"	Giff.,	"	Griff.
"	191,	"	19,	"	Obignyianus,	"	Orbignyianus.

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PART I.

REPORT

OF

JOURNEYS ACROSS THE ANDES AND PAMPAS

OF THE

ARGENTINE PROVINCES,

MADE UNDER INSTRUCTIONS FROM

LIEUT. J. M. GILLISS,

SUPERINTENDENT U. S. N. ASTRONOMICAL EXPEDITION,

BY

LIEUT. ARCHIBALD MACRAE, U. S. N.,

PRINCIPAL ASSISTANT.

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